Information Series No. 9

PROGRAM AND SUMMARIES

Ninth Annual

Open House and Review of Activities

November 27 and 28, 1985

Honourable Joel R. Matheson, Q.C., Minister
John J. Laffin, P.Eng., FEIC, Deputy Minister
HALIFAX, NOVA SCOTIA

1985

Nova Scotia
Department of
Mines and Energy

Canada - Nova Scotia
Mineral Development Agreement

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FOREWORD

I welcome you to the Department's Ninth Annual Open House and Review of Activities. It is a pleasure to see the interest you have in the activities of the Department.

The description in this Program and Summaries Booklet, the talks, and the displays indicate the diversity of responsibilities of this portfolio. This diversity more fully represents the activities of the Department which are of interest to the mining and exploration sector. The Open House has expanded over the years to include both the Mines and Minerals, and Energy Branches. In addition, you will see displays of work by the Geological Survey of Canada, other groups within Energy, Mines and Resources, Canada and the geology-related departments of Nova Scotia post-secondary institutions.

Most of the projects described in the Booklet and discussed during the Open House result from work supported by the Canada - Nova Scotia Mineral Development Agreement. This Agreement, which was signed in June 1984, supports a wide range of co-ordinated projects in mineral deposit investigations, commodity studies, marketing strategies and research, and advances in mineral technology.

The diversity of federal and provincial initiatives outlined at this Open House represent the first two years of this five year Agreement. I believe the private sector exploration and mining fraternity will derive a great deal of optimism and assistance from work, both completed and planned, under this Agreement.

I am happy to specifically note the positive private sector initiatives in metal exploration and mining in the Province. The recent gold development shaft announcement at Forest Hill and the beginning of production at the East Kemptville tin mine have given all of us a clear indication of major new growth in this sector. This complements the steadily increasing production statistics in our coal, aggregate, and industrial mineral sectors.

Thank you for attending and enjoy your stay with us.

Joel R. Matheson

Joel R. Matheson, Q. C.
Minister of Mines and Energy

PROGRAM

WEDNESDAY, NOVEMBER 27, 1985

14:00 Displays Open
14:00-17:00 Registration and Cash Bar
19:30-20:30 Registration
20:00-23:00 Displays Open, Informal Social Evening, Cash Bar

THURSDAY, NOVEMBER 28, 1985

08:00-10:30 Registration

08:30-08:40 WELCOMING REMARKS
John J. Laffin, P.Eng., FEIC,
Deputy Minister, Nova Scotia Department of Mines and Energy

ENERGY RESOURCES DIVISION

08:40-08:45 Andrew Batcup, Director
08:45-08:55 Review of Coal Exploration - Kevin Gillis
08:55-09:05 Cumberland Basin Coal Project - John Calder
09:05-09:15 Oil Shale Exploration - Rob Naylor
09:15-09:25 Oil and Gas Exploration Review - Paul Harvey

MINERAL DEVELOPMENT DIVISION

09:25-09:30 Dan Murray, Director
09:30-09:40 Mineral Exploration Update - Paul McCulloch
09:40-09:55 Industrial Minerals Activity Review - John Fowler
09:55-10:05 Mineral Inventory Project - Norman Lyttle
10:05-10:15 Gold Mines and Mining Study - Craig Miller

10:15-10:35 **BREAK**

FEDERAL PARTICIPATION IN THE MDA

10:35-10:45 Mineral Policy Sector, EMR Projects - Don Stonehouse
10:45-11:00 Activities of the Geological Survey of Canada - Fred Chandler

MINERAL RESOURCES DIVISION

11:00-11:05 Peter Giles, Director
11:05-11:15 Regional Geology- Duncan Keppie
11:15-11:25 Cumberland Basin Project - Bob Boehner
11:25-11:30 Base Metal Deposits Study - Jim Patterson
11:30-11:40 Gold Deposits - Paul Smith
11:40-12:00 South Mountain Batholith Project - Mike MacDonald, Phil Finck
12:00-12:10 Geochemistry Projects - Ron Mills
12:10-12:20 Surficial Geology and Till Geochemistry - Ralph Stea
12:20-12:30 Education and Public Awareness - Howard Donohoe, Martha Devanney

12:30 Review of Mineral Development Agreement Activities -
Jack Garnett, Assistant Deputy Minister

12:30-15:00 Cash Bar

12:45 **LUNCHEON** - Horatic's Buffet
Introduction to the Luncheon Speaker:
John J. Laffin, P.Eng., FEIC, Deputy Minister

Luncheon Speaker:
Honourable Joel R. Matheson, Q. C.
Minister of Mines and Energy

Thank you to the Speaker:
Roy Mosher, President
Chamber of Mineral Resources of Nova Scotia

15:00 Displays close.

PETROLEUM ACTIVITY UPDATE

P. J. Harvey

In early 1985 the completion of the Glenelg H-38 delineation well marked the 100th well to be completed offshore Nova Scotia. Exploration activity remained concentrated in the Sable Island area during 1985 and three previous discoveries were further evaluated by delineation drilling. The first new exploration agreements issued since 1982 were awarded during the past year. The resolution of the boundary line between Canada and the United States marked a step towards making the Georges Bank area available for exploration. Two very significant events occurred, in the development activities by Mobil and its partners, to produce the first offshore natural gas and natural gas liquids. In the onshore region, the regulatory framework of the new Petroleum Resources Act was put in place.

OFFSHORE

Exploration

Thirteen wells were completed during 1985 up to the first of October. Discoveries made during this period include the West Venture N-91 and C-62 wells, and the Chebucto K-90 well. The Chebucto discovery is expected to be delineated with the first well at the end of this year. One further delineation well was drilled on each of the Alma, Glenelg and Thebaud discoveries but further delineation is required to fully evaluate each structure. In addition to the wells completed, two wells are currently drilling at the time of this update.

Mobil, Shell, Husky/Bow Valley, Petro-Canada and Home, in conjunction with numerous partners, continued to operate well into 1985 while Mobil and Shell remained exploring by the last quarter of this year. In April 1985, consortiums led by Husky and Canterra acquired exploration agreements to the south of Sable Island which will mean future drilling by these two operators.

Canada acquired one-sixth of the Georges Bank in the Gulf of Maine-Georges Bank World Court boundary decision last fall. Geophysical activity has resumed in this area. However, any other exploration activity will be limited until fisheries and environmental issues are suitably resolved.

Development

Activities focused on developing Nova Scotia's offshore petroleum resources continued during 1985. Early in the year, Mobil and its partners in the Venture Gas Project signed agreements for the sale of natural gas to two major United States pipeline groups. In July 1985, the Project's major partners jointly filed an application to the National Energy Board to export 300 million cubic feet per day of sales gas to the two major United States groups with whom sales contracts have been negotiated. The export application indicates that the Venture, South Venture and Thebaud discoveries comprise the current Project, and account for 2.36 trillion cubic feet of proven and probable reserves presently identified in these three fields. Mobil and its partners have completed a second delineation well on the Thebaud discovery in September 1985 and are continuing to drill in the Sable Island area to identify additional reserves that can be developed in conjunction with the Venture Gas Project. The export application estimates the total cost of the Project will be $2.9 billion including the cost of the transmission system through Nova Scotia and New Brunswick to the United States border. Initial production is expected to begin in the fall of 1990.

ONSHORE

Since the regulatory framework for the Petroleum Resources Act is now in place, negotiations can be finalized between the Government of Nova Scotia and exploration companies wishing to retain their onshore petroleum rights. This is expected to initiate several drilling programs during the next few years.

Since the first recorded drilling began onshore in 1869, about 97 petroleum wells have been drilled into Carboniferous Age sediments situated in the northern portion of the Province. Besides these wells, wells drilled for other purposes have encountered petroleum shows while seismic lines have been acquired to evaluate the drilling potential onshore Nova Scotia. Work is proceeding on compiling petroleum shows, wells and geophysical information into reports to assist exploration companies in effectively evaluating the onshore petroleum potential.

PRELIMINARY OBSERVATIONS ON THE SEDIMENTOLOGY OF SELECTED SITES WITHIN THE DEBERT-KEMPTOWN COAL BASIN

J. H. Calder

INTRODUCTION

The Debert-Kemptown Basin (Fig. 1) is an 100 km^2, elongate Basin bounded on the north by the Cobequid-Chedabucto Fault and Cobequid Highlands, and by the Portapique Fault in the south. In the west and central areas of the Basin, the major structural feature is the Debert River syncline. The strata of this Basin have been assigned both to the Cumberland and Pictou Groups (Bell, 1958, Stevenson, 1958) or solely to the Pictou Group (Donohoe and Wallace, 1982), chiefly on the basis of age rather than preferred lithostratigraphic characteristics. Lortie (1979) proposed these strata be assigned to an informal Delaney formation. The age of the strata varies from early Westphalian B in the south and east to Westphalian C in the west, as determined by S. Barss on the basis of palynology (Donohoe and Wallace, 1982).

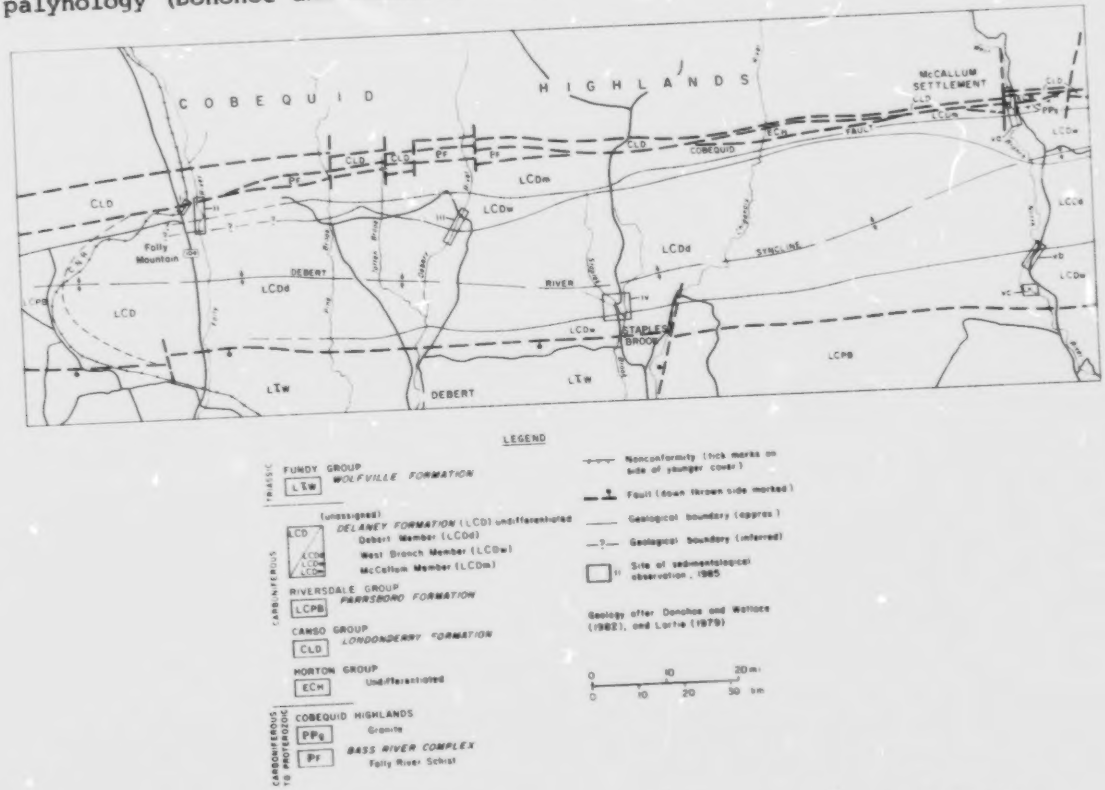


Figure 1. Selected sites within the Debert-Kemptown coal basin.

High volatile B bituminous coals were mined sporadically at Debert, Belmont (Chiganois River), Coal Mine Brook and Kemptown. An account of these operations is rendered by Stevenson (1958). At present it is not known whether these deposits are isolated or continuous. Accordingly, the Basin and seam architecture is poorly understood.

As a first step in documenting the geological setting of these coals to aid future exploration, the preliminary investigation of the sedimentology of selected sites within the Basin was begun in 1985. Strata in the west half of the Basin were examined according to the three members proposed by Lortie (1979). These members are: (1) the basal, conglomeratic McCallum Member, (2) the coal-bearing West Branch Member and (3) the upper, reddish Debert Member. At the sites observed, the Members exhibit distinctly different lithofacies assemblages.

Sites observed are: (i) the CN Railway cut near Folly Mountain cemetery, (ii) Folly River (north limb of syncline), (iii) Debert River near the site of past mining and 1970s Coal Inventory drilling (north limb), (iv) Staples Brook (south limb), and (v) West Branch of North River at the (a) northern basin margin, (b) central basin and (c) southern limb. A preliminary list of lithofacies observed thus far in the Debert-Kemptown Basin is presented in Table 1.

PRELIMINARY SEDIMENTOLOGY OF BASIN MARGIN STRATA

The sedimentology of basal rocks at the northern margin (sites ii and v) is depicted in Figures 2 and 3. On Folly River (Fig. 2a) approximately 145 m of extra-basinal cobble, and rare boulder conglomerates are exposed as isolated cliffs 20 to 30 m high. The conglomerates eventually grade upward from clast-to-matrix supported (Gc and Gm), and fine above 135 m to pebble conglomerate. Bedding in the high cliffs is difficult to discern but appears to be crudely trough crossbedded (large-scale) to planar.

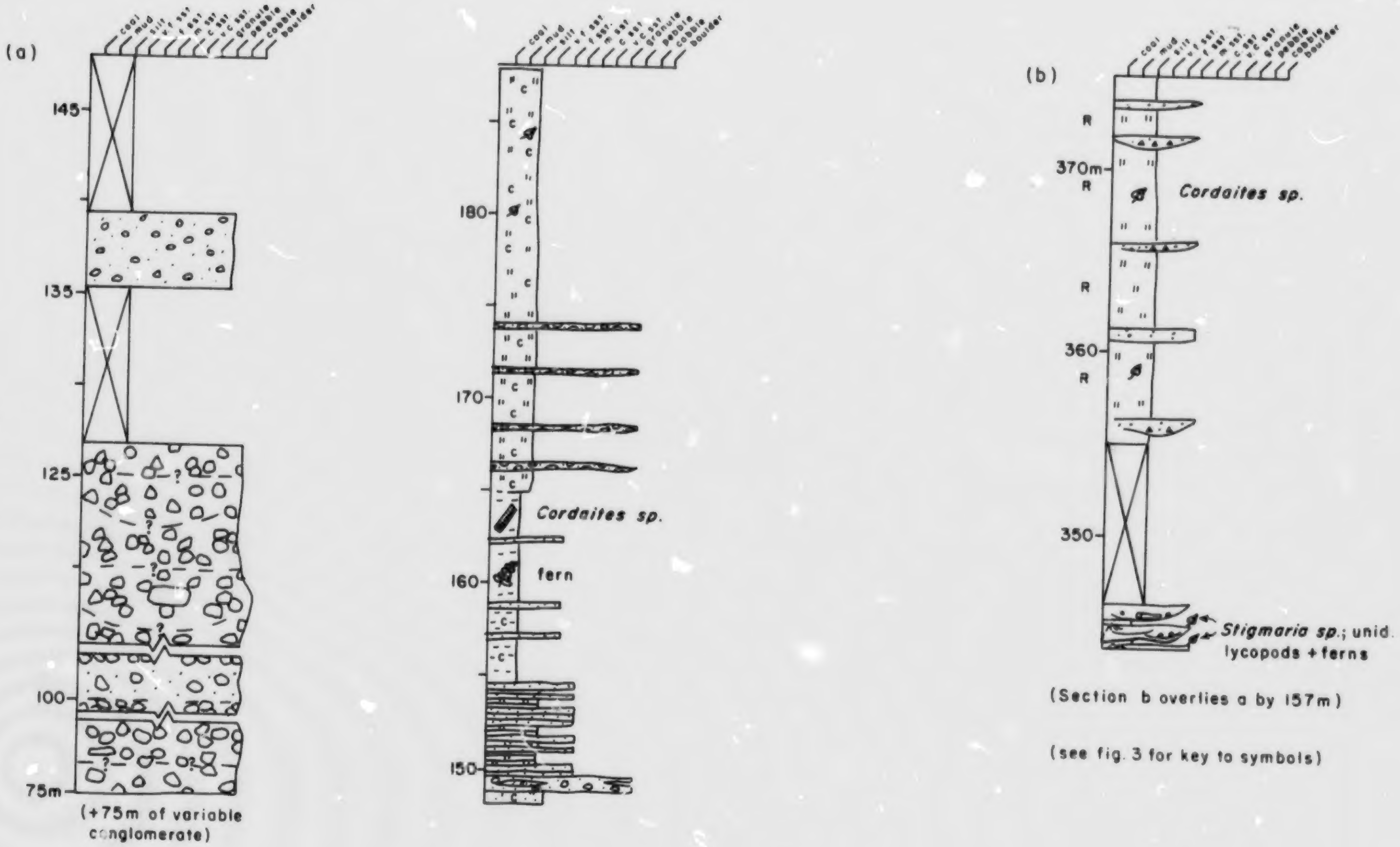
Clasts are predominantly granite, and quartzite with subordinate diorite and gabbro. These are likely derived from Cambrian granites, Proterozoic Gamble Brook schist, and other components of the Cobequid Highlands to the north (H. V. Donohoe, personal communication).

At a point approximately 148 m from the base of the conglomerates (Fig. 2a), there is a distinct change in lithofacies, marked by 10 cm thick beds of Si, Fc(g) and Sp overlain in turn (at 165 m) by thin 10 cm thick, solitary beds of facies Gm, similar in composition to the basal conglomerates described above. High in the section at approximately 335 m (Fig. 2b), siltstone (Fg and Fc(g) is dominant, with occasional deep scours of Ss.

On the West Branch of the North River near McCallum settlement (site va), the nonconformable Basin margin contact between Cambrian granite (Donohoe and Wallace, 1982) and basal conglomerates of the McCallum Member is exposed. Clast composition is similar to that described above Folly River. The immediately overlying strata is a 30 m upward-fining cycle (I in Fig. 3a) composed primarily of clasts apparently identical to the exposed Cobequid 'basement' rocks. A second fining-upward cycle, approximately 55 m thick, and an overlying coarsening-upward cycle (II and III, Fig. 3a) also contain sandstone and gabbro clasts. Crude trough crossbeds are common. The cycle and clast lithology variations may be the result of

Table 1. Preliminary list of observed lithofacies of the Debert-Kemptown basin (west half).

Code	Lithofacies	Grain Size	Colour	Sedimentary Structures	Fossil content	Site(s) (see text)	Member of Lortie (1978)
Gm	matrix-supported extra-basinal conglomerate	pebble to cobble	var. grey	crude planar to large-scale trough crossbeds		i, ii, va	McCallum
Gmt	matrix-supported extra-basinal conglomerate	granule	var. grey	well developed shallow trough crossbeds		va	McCallum
Gmq	stratified, graded extra-basinal conglomerate (with interstratified sandstone)	granule	grey	planar crossbeds (large scale)	large (0.5m diameter) rafted(?) lycopod trunks (rare?)	vc	West Branch
Gc	clast-supported, extra-basinal conglomerate	pebble to boulder	var. grey	massive ?		i, ii	McCallum
Ss	moderately sorted sandstone with matrix-supported intraformational clasts	medium to coarse	grey	deep scours	rafted stems of *Calamites sp.* et al.	ii	McCallum/ West Branch transition
St	thinly bedded, moderate to well sorted sandstone	medium	grey	low angle trough crossbeds		ii, iv	West Branch; Debert
Sp	well sorted, thinly bedded sandstone	fine	grey	tabular, planar	occasional comminuted plant fragments	vb	McCallum/ Debert transition
Sr	well sorted, thinly bedded sandstone	coarse silt to fine sand	grey	ripples		vb	McCallam/ Debert transition
			(rarely reddish-grey)			(iv)	(Debert)
Si	thinly interlaminated/interbedded mudstone, siltstone and sandstone	mud to fine sand	grey	wavey-planar with large ripples	*Cordaites sp.*	vc	West Branch
Si(r)	thinly interlaminated/interbedded mudstone, siltstone and sandstone	silt and very fine sand	reddish-brown	tabular; occasional ripples		iv	Debert
Sd	very thinly bedded, well sorted carbonaceous sandstone with extensive soft sediment deformation	very fine	grey	thin, tabular-planar; also rippled	highly comminuted plants	iii	West Branch
Sb/ Fb	fossiliferous siltstone/ sandstone	silt to very sand			chaotic assemblage of *Cordaites sp.*, *Calamites*(?), and bivalves	vc	West Branch
F(g)	thin to thickly bedded mudstone/siltstone	clay/silt	grey to dark grey	planar	occasional comminuted plants	ii	West Branch?
F(r)	thin to thickly bedded mudstone/siltstone	clay/silt	reddish-brown	planar	occasional comminuted plants	iv	Debert
Fc(g)	carbonaceous mudstone	clay/silt	dark grey	occasional dessication cracks, massive, planar	*Stigmaria sp.* *Neuropteris sp.* *Annularia sp.*, lycopods; well preserved to comminuted	ii, ivc	West Branch
Fc(r)	carbonaceous mudstone	clay/silt	mottled (reddish-brown grey)	planar, massive	*Cordaites sp.*, moderately preserved to comminuted	ii	West Branch/ Debert Transition
Fs	siderite-banded mudstone	clay/silt	dark grey	planar	?	iii	West Branch
Ccs	carbonaceous to coaly shale, moderately fissile	clay/silt	dark grey to black	laminated	?	vc	West Branch
Cc	clarain (coal)		semi-bright black	normal-banded	?	iii	West Branch



(Section b overlies a by 157m)

(see fig. 3 for key to symbols)

Figure 2. Vertical profiles of strata exposed on Folly River, northern margin of Debert-Kemptown coal basin.

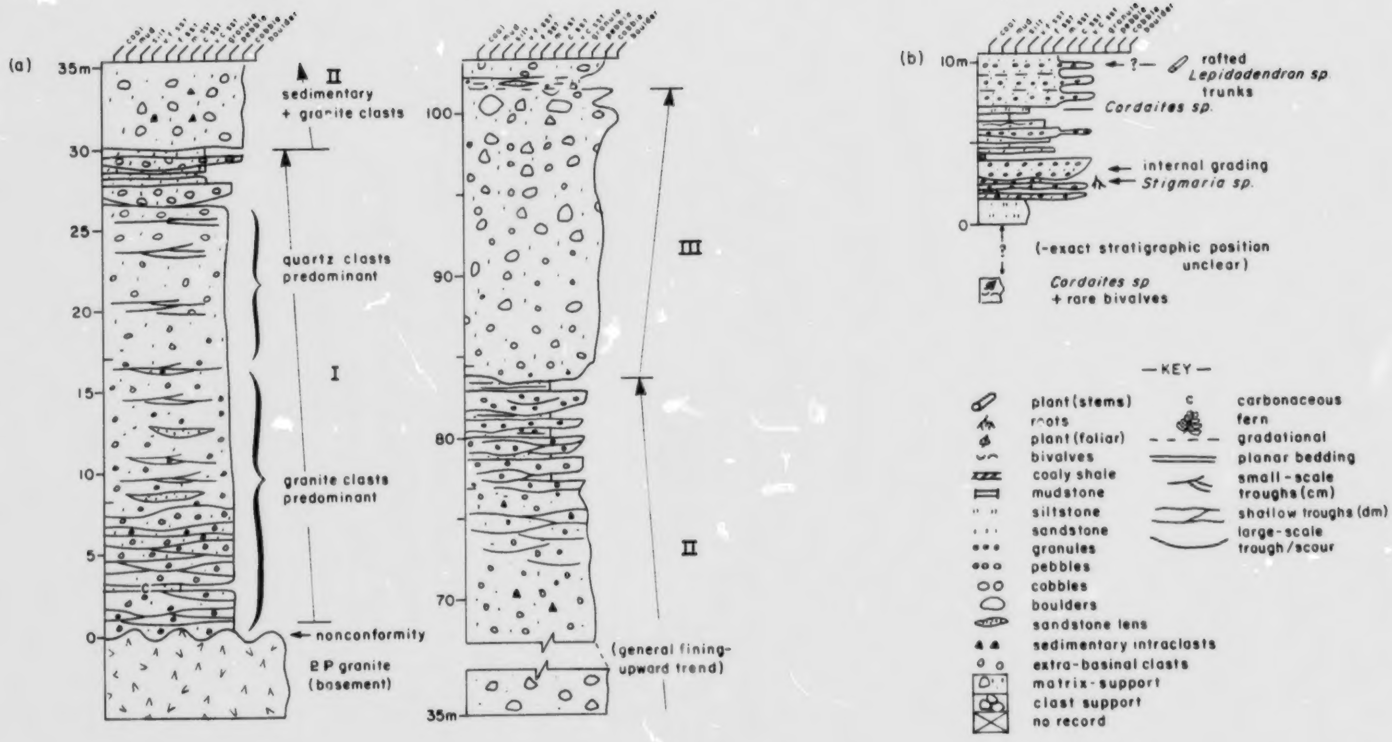


Figure 3. Vertical profiles of strata exposed on West Branch, North River; (a) on north limb of Debert syncline and (b) on south limb of syncline, Debert-Kemptown coalfield. (West Branch Member of Lortie (1979)).

fan-lobe switching or the effect of marginal faulting introducing different rock types to erosional forces, or both.

Exposed on the opposite side of the Debert River syncline, are strata (Fig. 3b) which appear to be juxtapose to the McCallum and West Branch Members of Lortie (1979). Graded, fine quartz pebble conglomerates (Gg) are found interbedded with thin, impure coaly shales (Ccs) and carbonaceous mudstones (Fc(g)). Rafted (?) lycopod trunks 0.37-0.56 m in diameter within facies Gg, and other flora from Fc(g) and Ccs suggest high energy incursions into a poorly established coal swamp flora. The presence of bivalves, observed in conjunction with Cordaites sp. in facies Fb, is significant as it suggests the presence of a lacustrine component of the paleoecology.

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1979: Stratigraphy of the Carboniferous sedimentary rocks north of Debert, Colchester County, Nova Scotia; *in* Mineral Resources Division, Report of Activities, 1978; Nova Scotia Department of Mines and Energy, Report 79-1, p. 43-49.

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COAL RELATED DRILLING ACTIVITIES - CAPE BRETON

D. J. MacNeil

INVESTIGATION OF THE BONAR (LLOYD COVE) SEAM - POINT ACONI

In March 1985, drilling was conducted at Point Aconi, Cape Breton County under the auspices of the Mining Engineering Division. Five holes totalling 129.5 metres were drilled to delineate the structure of the Upper and Lower Bonar seams, and the lateral variability in thickness and lithology of an interseam parting. All holes were geophysically logged in accordance with coal section practice.

The Bonar (Lloyd Cove) Seam occurs near the top of the productive coal measures of the Sydney Mines Formation, Morien Group. At Point Aconi the seam is characterized by a significant parting, lens-shaped in cross-section (viewed down-dip), which increases from about two metres on the west shore of Point Aconi to nine metres on the east shore. Further southeast, it disappears south of Alder Point. Limited data suggest the axis of this parting trends northeast, conforming to the dominant paleocurrent direction in the coalfield (Forgeron et al., 1982).

Lithologically, the parting consists of interbedded fine-to medium-grained sandstones, siltstones and mudstones, exhibiting distinct coarsening upward tendencies and containing common silicified plant fragments. These observed features support the work of Gibling and Rust (1984) who interpreted part of this sequence as a levee deposit. The thick, sandy axial zone would appear to represent a proximal channel and the thin mudstone a distal fringe of a levee complex.

The Upper Bonar appears to thin toward the axis of the parting. This probably reflects differential compaction of the off-axis mudstones, which, in turn, allowed thicker peat deposits to accumulate.

INVESTIGATION OF MAPLE BROOK COAL OCCURRENCE

In August - September 1985, two drillholes totalling 464 metres were drilled to investigate a coal showing in the Mabou Formation of the Maple Brook Syncline, east of Glendate Inverness County, approximately 20 km from Port Hastings. Apparently, an attempt was made to drill test this occurrence in the early part of the century. In 1932 a tunnel was driven on the seam with the intent of commercial development. These projects are poorly documented.

Drilling and field mapping were conducted to document the occurrence, to determine resource potential and to establish the stratigraphic setting. Preliminary examination of the results show the Maple Brook Seam to be a 45 cm thick horizon of coaly shale with limited areal extent. Analysis and compilation of the information is continuing.

6

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1982: The effects of geological features on coal mining, Sydney Coalfied; Canadian Institute of Mining and Metallurgy, District No. 1 Meeting, Fredericton, New Brunswick, preprint No. 42.

Gibling, M. R. and Rust, B. R.
1984: Sedimentology of the Morien Group near Alder Point, Sydney Basin; *in* Mines and Minerals Branch, Report of Activities 1983; Nova Scotia Department of Mines and Energy Report 84-1, p. 71-83.

PRELIMINARY REPORT ON THE OIL SHALES OF THE STELLARTON BASIN, PICTOU COUNTY, NOVA SCOTIA*

R. Naylor, G. Prime and B. Smith

The oil shales of the Stellarton Basin have been examined by various authors including Ells (1909; 1910), Wright (1922), Bell (1924), Flynn (1926), Douglas and Campbell (1941), Potter (1974; 1975; 1976) and Macaulay and Ball (1984).

The present study focuses on the stratigraphy and sedimentology of the oil shales and associated clastics of the Stellarton Group. The information gathered will ultimately be used to outline the geological controls on oil shale deposition within the Stellarton Basin. A brief outline on some of the project activities and findings is presented below.

STRATIGRAPHY

The major lithostratigraphic group outcropping within the Stellarton Basin is the Westphalian B-C Stellarton Group. The oil shales are restricted to the grey coal-bearing Westville, Albion, Coal Brook and Thorburn Members of the Stellarton Group. The two uppermost Members (the Coal Brook and Thorburn) were examined during the 1985 field season.

To date, in excess of 40 individual oil shale units have been identified within the Coal Brook and Thorburn Members. These units vary in thickness from less than one metre to 35 metres. Stratigraphic sections constructed from geological mapping and drillhole information indicate individual beds can be traced laterally over minimum distances of three to five kilometres.

The lateral continuity of oil shale units makes the investigation of their utilization potential more attractive. In addition, the oil shales provide excellent stratigraphic markers for detailing the stratigraphy, the structure and the lithofacies variation within the basin.

The clastics associated with the oil shales are not easily traced laterally. This is particularly evident with the sandstone bodies which appear to undergo rapid lateral facies changes on the scale of 100 to 500 metres.

A note of stratigraphic interest is the apparent lateral facies equivalence of the oil shales and coals. Both the McBean and Six-Foot seams (Thorburn Member) and the McLeod seam (Coal Brook Member) can be traced laterally to oil shale units. Conversely this suggests the possibility that other oil shale units could be traced laterally to significant coal seams.

LITHOLOGY OF THE OIL SHALES

Macroscopic and microscopic descriptions of the oil shales are being used to develop a classification system for oil shale lithotypes

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*Funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement

(Table 1). This classification system will ultimately be used to estimate potential hydrocarbon yields as determined by Rock-Eval pyrolysis.

In addition to the features listed in Table 1, the presence of fossil flora (e.g. Cordaites sp.; Lepidodendron sp.; Lepidostrobus sp.; Trigonocarpus) and fauna (e.g. ostracods, pelecypods, fish teeth and scales) are being noted. Microscopic examination of the oil shales has focused on maceral descriptions using fluorescence microscopy. It is believed the organic petrology of the oil shales will have a useful correlation with potential hydrocarbon yields.

Table 1. Preliminary classification of oil shale lithotypes.

LITHOTYPE	COLOUR	STREAK	FRACTURE	TOUGHNESS	TEXTURE	APPEARANCE
Oil Shale C	dark grey to black; locally colour-banded dark grey and black	waxy dark grey	planar to irregular	brittle	smooth	non-laminated; exhibits sub-fissility
Oil Shale B	black	waxy light brown	irregular	brittle to tough	smooth	non-laminated; exhibits sub-fissility
Oil Shale A	black	waxy dark brown	irregular to sub-conchoidal	brittle to tough	smooth	non-laminated; exhibits sub-fissility
Torbanite	black with a bluish lustre	waxy dark brown to black	conchoidal	tough; gives a distinct 'ring' when struck with a hammer	smooth to granular	massive; exhibits little fissility
Stellarite	black	waxy brown	irregular	brittle to tough	smooth	laminated; often contorted

LITHOLOGY OF CLASTICS

In general the thickest oil shales occur interbedded with rhythmically layered silts and clays. Oil shales of intermediate thickness are found interbedded with low angle trough-crossbedded rippled sandstones and wavy to lenticular thinly interlaminated siltstone and sandstone. The thinnest oil shales are generally associated with high angle trough cross-bedded sandstones, and massive to cross-stratified pebble to cobble conglomerates.

DEPOSITIONAL ENVIRONMENTS

A lacustrine deposition environment has been interpreted for the oil shales. Evidence which supports this interpretation includes associated clastics (rhythmically layered claystones) and fauna (paleoniscoid fish scales and teeth).

The thickness and lateral extent of individual oil shale units indicate lacustrine conditions were relatively widespread. The lateral facies equivalence between the coals and oil shales suggests many of the lakes were bordered by vegetated swamps.

The clastics associated with the oil shales appear to represent a wide spectrum of depositional environments including lacustrine deltas, fluvial channels and alluvial fans.

Figure 1 illustrates the possible distribution of paleoenvironments during deposition of the Stellarton oil shales.

FORTHCOMING REPORTS

An interim report on the oil shales of the Basin is expected to be published in the spring of 1986. The report will include a 1:5000 scale geological map of the east half of the Stellarton Basin.

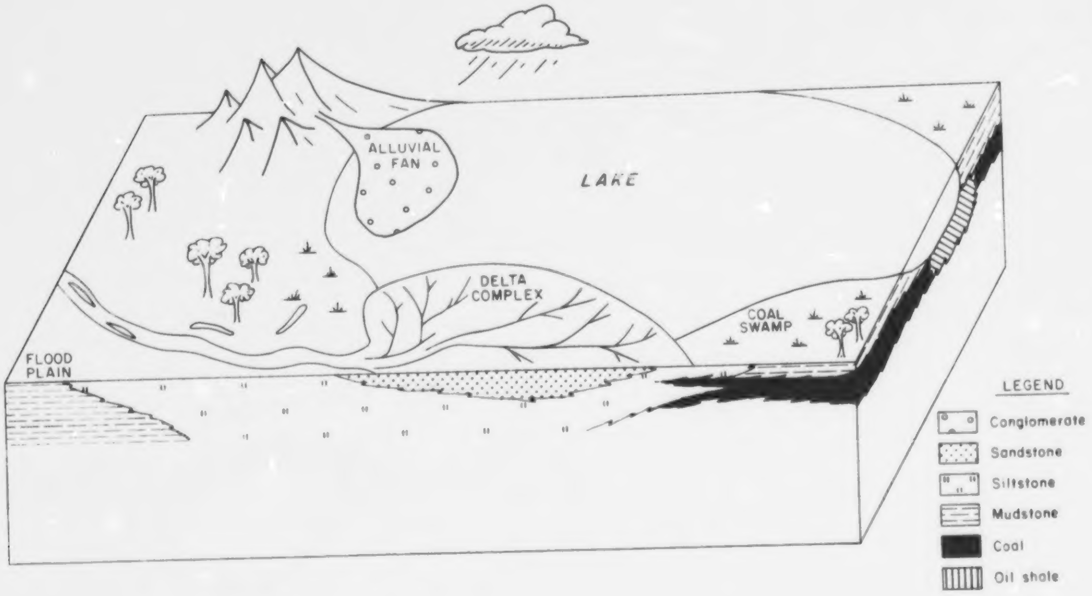

Figure 1. The possible distribution of paleoenvironments during deposition of the Stellarton oil shales.

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PEATLAND INVENTORY PROGRAM

A. R. Anderson and W. Broughm

INTRODUCTION

The Province of Nova Scotia has approximately 400 000 acres (160 000 ha) of peatland distributed throughout five or six loosely defined concentrated regions (Fig. 1).

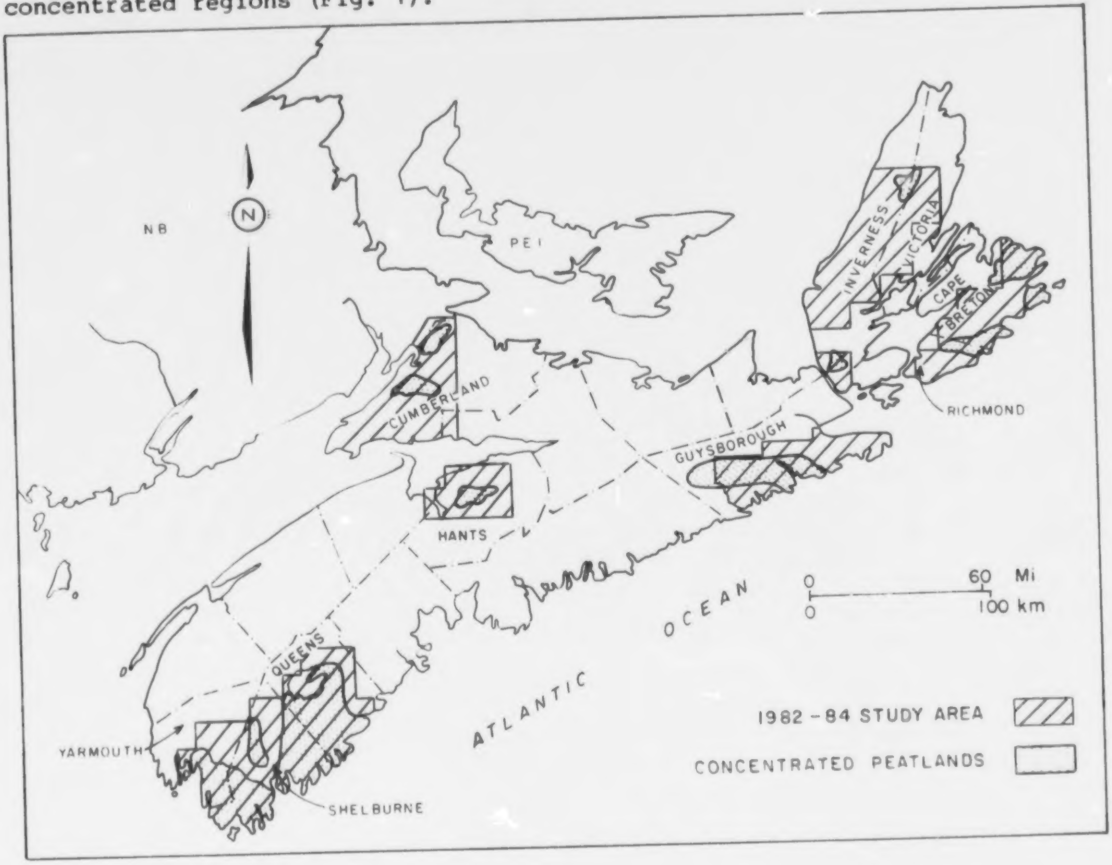

Figure 1. Peatland concentration region in Nova Scotia.

The Peatland Inventory Program was initiated in 1979 and has studied the more significant peat deposits in these regions with the mandate to determine the extent of the peat resource and the amount of fuel peat throughout the Province.

Field inventory programs from 1980-84 investigated peat deposits in Yarmouth, Shelburne, Queens, Kings, Hants, Halifax, Cumberland, Pictou and Guysborough counties as well as the four counties of Cape Breton Island (Table 1).

Table 1. Nova Scotia peatland inventory preliminary resource data.

Region	Resource Status	Area Hectares	Average Depth (m)	In situ Volume (x 10^6 m^3)			Tonnage* (x 10^6 tonnes)			% Fuel Grade By Weight
				H^{1-4}	H^{5-10}	Total	H^{1-4}	H^{5-10}	Total	
Southwestern Nova Scotia	Investigated (1980-83)	16725	2.1	165.1	209.1	374.2	24.1	39.7	63.8	62
	(1984)	1150	2.1	12.3	11.9	24.2	1.8	2.3	4.1	56
	Total Estimated	38000	2.1	352	446	798	51	85	136	62
Halifax County	Investigated (1981-82)	263	3.1	6.9	1.1	8.0	1.0	0.2	1.2	17
Kings County	Investigated (1982)	504	2.2	5.5	5.5	11.0	0.8	1.1	1.9	57
	Total Estimated	4451	2.2	48	49	97	7	9	16	57
Hants County	Investigated (1982)	2237	3.2	51.0	29.0	80.0	7.5	5.5	13.0	42
	Total Estimated	5851	3.2	120	67	187	18	13	30	42
Cumberland County	Investigated (1983)	3500	2.5	65.0	22.0	87.0	9.5	4.2	13.7	31
	Total Estimated	6700	2.5	126	42	168	18	8	26	31
Guysborough County	Investigated (1983)	3900	2.5	78.0	20.0	98.0	11.0	4.0	15.0	27
	Total Estimated	14400	2.5	286	74	360	42	14	56	27
Cape Breton West	Investigated (1984)	1740	1.6	21.5	5.0	26.5	3.1	1.0	4.1	24
	Total Estimated	9370	1.6	122	28	150	18	5	23	24
Cape Breton East	Investigated (1984)	3180	2.7	67.1	17.5	84.6	9.8	3.3	13.1	25
	Total Estimated	15988	2.7	337	88	425	49	17	66	25

*Tonnes at 50% Moisture Content have been calculated using values abridged from Montreal Engineering Co. Ltd. (1980). These values are: H^{1-4} peat = 0.146 t in situ m^3
H^{5-10} peat = 0.190 t in situ m^3

Yarmouth, Shelburne and Queens counties comprise the southwestern Nova Scotia study area (Fig. 1). A total of 44,160 acres (17 875 ha) of peatland have been evaluated with reserves of 520 million cubic yards (398 million m^3) of in situ peat. Relative tonnages (at 50 per cent moisture content*) indicate 62 per cent of the peat inventoried in this region is estimated to be suitable fuel grade** peat.

Deposits evaluated in Hants County cover about 5,400 acres (2 200 ha). These peatlands contain approximately 105 million cubic yards (80 million m^3) of in situ peat of which 36 per cent is fuel grade peat.

Deposits evaluated in Cumberland County contain approximately 115 million cubic yards (87 million m^3) of in situ peat. An area of 8,600 acres (3 500 ha) of peatland was studied, and data indicate 25 per cent of the peat could be classed as fuel grade.

Guysborough County peat deposits are generally quite small, but numerous. About 150 deposits were sampled revealing approximately 128 million cubic yards*** (98 million m^3) of which 20 per cent by weight can be classified as fuel grade peat. A total of 15 million tons+ (14 million tonnes) were investigated in this region.

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*In situ weight is calculated at 50 per cent moisture content.

**Fuel grade - peat between 5 and 10 on von Post humification scale.

***All volumes expressed are in situ.

+All tonnages are in situ at 50 per cent moisture content.

Peatland in Halifax and Kings Counties were not targeted to be investigated by this inventory program. However, outside interests requested the evaluation of 650 acres (263 ha) of peatland in Halifax County and 1,245 acres (504 ha) in Kings County. Volumes of 10 and 14 million cubic yards (8.0 and 11.0 million m^3) were studied of which 17 per cent and 57 per cent respectively were found to be of fuel grade quality.

A number of small deposits in the New Glasgow - Pictou areas were surveyed as part of the inventory program. The deposits were near roadways and fairly close to the major centres of the region making them attractive for small development if suitable fuel peat could be found. A total of 870 acres (350 ha) were surveyed. However, most of the resource (90 per cent) was moss grade and most of the fuel considered not mineable.

FUEL PEAT RESOURCE

The Inventory Program has covered a total of 81,800 acres (33 100 ha) of peatlands on mainland Nova Scotia (Table 2). The volumes associated with this total are 617 million cubic yards (472 million m^3) moss grade peat and 420 million cubic yards (321 million m^3) fuel grade peat. These volumes equate to 69 and 61 million tons (68 and 60 million tonnes), respectively. Extrapolation provides estimates of total resources in the study regions of 200 million tons (180 million tonnes) of moss grade peat and 150 million tons (135 million tonnes) of fuel grade peat.

Known fuel grade deposits that may be considered for potential development are located in the Lake Rossignol region of Queens County, and the Clyde River to Pubnico of Shelburne and Yarmouth Counties. Other fuel be classified as fuel grade peat. A total of 15 million tons⁺ (14 million tonnes) were investigated in this region.

Table 2. Preliminary peatland inventory and resource data.

Region	Total Area Investigated acre(hectare)	% of Total Resource Area Investigated acre(hectare)	Average Depth feet (metres)		Insitu Tonnage (50% M.C.) (x 10^6)	% Fuel Grade Peat by Weight
Southwestern Nova Scotia	44,160 (17,875)	47	6.9	(2.1)	63.0	62
Halifax Co.	650 (263)	2	10.2	(3.1)	1.2	17
Kings County	1,250 (504)	11	7.2	(2.2)	1.9	57
Hants County	5,527 (2,237)	37	10.5	(3.2)	13.0	42
Cumberland Co.	8,650 (3,500)	52	8.2	(2.5)	13.7	31
Guysborough Co.	9,640 (3,900)	27	8.2	(2.5)	15.0	27
Cape Breton (West)	4,300 (1,740)	19	5.2	(1.6)	4.1	24
Cape Breton (East)	7,860 (3,180)	20	8.9	(2.7)	13.1	25
Province Total	8 1,800 (33,100)	21	-	-		

"PRELIMINARY PEATLAND INVENTORY AND RESOURCE DATA"

The Lake Rossignol region has roughly 14 sites where substantial fuel peat resources (2.8 million tons (2.5 million tonnes)) are found. These areas total 2,360 acres (940 ha) while 1,530 (610 ha) are considered as potential mine sites. This resource could be used to supply the hog fuel fired boiler at the nearby pulp mill. In the Yarmouth - Shelburne areas, 1,900 acres (760 ha) have been considered as fuel grade peat supplies (2.1 million tons (1.9 million tonnes)). These deposits are very close to a great number of small resource base industries that may prove to be a good consumer base for a fuel peat industry. The Tusket Bog could also supply peat to this region.

The fuel peat in the Aylesford deposit could prove valuable to the solid fuel combustion system being used in the Valley as well as act as a source of energy for the peat moss operation.

As a result of the inventory program, approximately 5,200 acres (2 100 ha) of peatland throughout southern Nova Scotia, has been identified as potentially mineable for fuel peat production. Developed to its full, this resource would yield roughly 7.2 million tonnes fo fuel peat over the next 15 - 20 years.

PEAT MOSS RESOURCES

The extent of moss grade peat is perhaps the most significant character of the Province's peat resource. Virtually every deposit surveyed has substantial amounts of moss grade peat.

The most notable deposits are in Hants County, particularly the Stanley-Kennetcook area. Roughly 45 million cubic yards of the in situ peat moss resource were identified in the region. The most significant deposits are found in the MacDonald, Petite and Colin Bogs. Combined, these contain nearly 32 million cubic yards (70 million bale equivalents) of peat moss. These deposits are large, containing substantial reserves, and are near railway and direct trucking access to Halifax for shipment overseas.

RESOURCE MAPPING

The peat resource will be summarized on three map sheets (1:250 000 scale) which will display relative peatland size, distribution and simple classification of peatland type. These maps were prepared from 1:63 360 photography, that were digitized and scale rectified for output at MRMS. Final copies will be available as part of the final report on the program.

Maps of all the peatlands surveyed are available in a series of 1:10 000 map sheets that display surface cover and relief, peat thickness and quality, as well as roads and drainage associated with peat deposits.

Information regarding the peat resource is available now on a demand basis and will be available upon request through software programs.

DRILL CORE LIBRARY

J. M. McMullin and J. D. Langille

INTRODUCTION

The Nova Scotia Department of Mines and Energy (NSDME) maintains core storage facilities at four locations.

The main facility is in the Stellarton Industrial Park and consists of three buildings with a combined storage area of 2100 m^2 (22 600 ft^2) and a heated laboratory with an area of 93 m^2 (1000 ft^2). Total capacity is about 330 000 m (1 000 000 ft.) of drill core which is stored on approximately 1700 pallets. These pallets can be moved to viewing areas as required by a propane-powered forklift truck.

At present, these three buildings are near full capacity and work has begun under the Canada - Nova Scotia Mineral Development Agreement (CNSMDA) to plan for the construction of an additional building in 1986 and to reduce the volume of the core now in storage, by detailed evaluation and selective disposal. A project geologist and a mineral technician have been hired for the duration of the CNSMDA to carry out the latter process.

Core is also stored at the regional office of the Nova Scotia Department of Mines and Energy on Bridge Avenue in Stellarton, at a building in the Debert Industrial Park, Colchester County and at a building near Malagawatch, Inverness County.

Most core is non-confidential, although the reference assessment data has a confidentiality period of two years and limited sampling may be permitted with certain restrictions. Diamond saws and core splitters are available for sampling, and a binocular microscope and ultraviolet light are available for visitors' use.

None of the facilities are staffed on a regular full-time basis, and anyone wishing to examine any core is advised to contact John McMullin, Jim Langille or Dennis Murphy at (902) 752-8429 at least one day in advance of visiting the core facility.

For the 12 month period ending October 1985, a total of 67 000 m (219 800 ft.) of additional core has been received at the Stellarton core library from 19 companies or organizations responsible for 50 separate projects (more than 833 holes), some of which date back twenty years. A complete list is appended.

Nova Scotia Department of Mines and Energy welcomes donations of complete core sections although space limitations require that such donations are subject to selective acceptance.

DRILL CORE ACQUISITIONS AT NSDME CORE LIBRARY

October 1, 1984 to October 17, 1985

Company or Group	Location of Drilling	Year of Drilling	No. of Holes	Total Metres
Aquitaine Company of Canada Limited	Coxheath Hills, Cape Breton County	1976	8	768
EMR-Earth Physics Branch	Wedgeport, Yarmouth County	1985	1	480
Esso Minerals Canada	Meadowbrook, Antigonish County	1979	6	190*
Esso Minerals Canada	Canfield Creek, Cumberland County	1980/82	35	2 695
Esso Minerals Canada	Cumberland Basin, Pictou, Colchester and Cumberland Counties	1981/82	36*	4 950*
Getty Mines Limited	Cheticamp, Inverness County	1974/75	2	691
Golden Caribou Explorations Incorporated	Caribou, Halifax County	1983	*	125*
Goldenville Explorations Limited	Goldenville, Guysborough County	1983/84	7	7 348*
Imperial Oil Limited/ Jorex Limited	Chaswood, Halifax County	1973	7	166
Imperial Oil Limited/ Jorex Limited	Coldstream, Colchester County	1973	7	312
Imperial Oil Limited/ Jorex Limited	Nine Mile River, Hants County	1973	7	325
Imperial Oil Limited/ Jorex Limited	Hopewell, Pictou County	1973	6	127
Imperial Oil Limited	Horne Settlement, Hants County	1973	4	445*
Imperial Oil Limited	Latties Brook, Hants County*	1973/74	4	165*

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*subject to verification

Company or Group	Location of Drilling	Year of Drilling	No. of Holes	Total Metres
Imperial Oil Limited	Pomquet, Antigonish County; Captains Pond, Antigonish County	1973/74	*	2 050*
Imperial Oil Limited	Sylvan Valley, Antigonish County	1974	1	353
Imperial Oil Limited	Mt. Thom, Colchester County	1974	1	507
Imperial Oil Limited	Ohio, Antigonish County	1974/79	21	500*
Imperial Oil Limited	Addington Forks, Antigonish County	1974/75	1	230
Imperial Oil Limited	Limerock, Pictou County	1976	2	180
Imperial Oil Limited	Smithfield, Colchester County	1977/79	9	800*
Imperial Oil Limited	Glenbervie, Colchester County	1977/78	11	590*
Imperial Oil Limited	Rutherford Brook, Colchester County	1978	2	207*
Imperial Oil Limited	Brookfield, Colchester County	1978	2	35
Imperial Oil Limited	Dalhousie East, Annapolis County	1978/79	59	2 663*
Isaac's Harbour Gold Explorations Incorporated	Goldboro, Guysborough County	1984	8	559
Lake Mine Resources Incorporated	Caribou, Halifax County	1983	3*	1 120*
Magcobar/Dresser	Walton Mine, Hants County	various	460*	15 300*
Mariner Mines Limited	Coxheath Hills, Cape Breton County	1965	22	3 150*
Noranda Exploration Company Limited	Kempt Road, Richmond County	1981	1	716*

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*subject to verification

Company or Group	Location of Drilling	Year of Drilling	No. of Holes	Total Metres
Noranda Exploration Company Limited	Gillis Mountain, Cape Breton County	1982	2	179
Noranda Exploration Company Limited	Musquodoboit Harbour, Halifax County	1982	1	165
Nova Scotia Department of Mines and Energy	Clarksville-West Gore, Hants County	1984/85	1	568
Nova Scotia Department of Mines and Energy	Point Aconi, Cape Breton County	1985	5	104
Nova Scotia Department of Mines and Energy	River Road, Pictou County	1985	1	626
Nova Scotia Department of Mines and Energy	Big Tom Wallace Lake, Digby County	1985	1	1 434
Nova Scotia Department of Mines and Energy	Sinclair Lake, Guysborough County	1985	2	641
Nova Scotia Department of Mines and Energy	Maple Brook, Inverness County	1985	2	445
Nova Scotia Department of Mines and Energy	Springhill, Cumberland County	1985	1	270
Pan East Resources Incorporated	Fifteen Mile Stream, Halifax County	1985	11	1 346
John Riddell	Oceanview, Cape Breton County	1981	2	162
Seabright Resources Incorporated	Forest Hill, Guysborough County	1982/83	13	2 146
Seabright Resources Incorporated	Mill Village, Queens County	1984	10	585
Seabright Resources Incorporated/MEX Explorations Limited	Westfield, Queens County	1985	5	707*
Sherritt Gordon Mines Limited	Caribou, Halifax County	1981	11	2 240*
Suncor Incorporated	New Glasgow, Pictou County	1984	13	6 925

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*subject to verification

Company or Group	Location of Drilling	Year of Drilling	No. of Holes	Total Metres
U. S. Borax and Chemical Corporation	Dufferin Mine, Halifax County	1984	3	407
U. S. Borax and Chemical Corporation	Farmington, Cumberland County	1983	4	171
U. S. Steel (Essex Minerals)	Sporting Mountain (Oban), Richmond County	1969	12	132
TOTAL			833(+)	67 000 m
				(219 827 ft.)

METALLIC MINERALS - EXPLORATION AND DEVELOPMENT

P. McCulloch

EXPLORATION ACTIVITY

General

Exploration for metallic minerals in the Province during 1985 has remained at generally the same level of activity as 1984 with a small increase noted in the exploration for gold. Exploration for base metals continues to be dominated by the search for tin and tungsten whereas exploration for copper, lead, zinc and associated metals remain at consistently low levels. Exploration for gold continues to highlight exploration activities in Nova Scotia and is focused primarily on the historical Cambro-Ordovician Meguma metasediments of mainland Nova Scotia and to a lesser extent on volcano-sedimentary environments in the Cape Breton Highlands (Fig. 1).

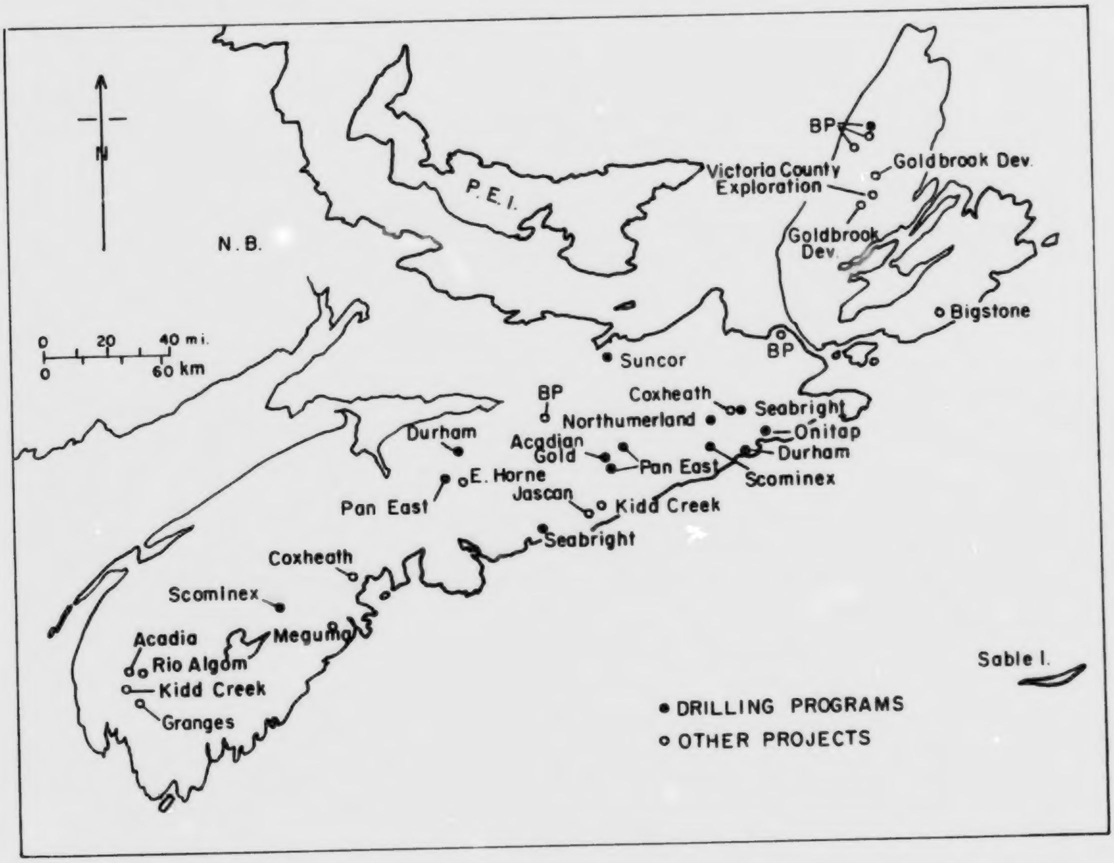

Figure 1. Location of major exploration programs in Nova Scotia 1985.

Base Metals

Exploration for tin and tungsten was carried out primarily by major companies in the area of the South Mountain Batholith complex in Yarmouth and Shelburne Counties, and the Musquodoboit Pluton in Halifax County.

Kidd Creek Mines Limited continued a detailed exploration program for tin and tungsten in the Tangier Grand Lake area in Halifax County and carried out additional work on properties in Yarmouth County. Rio Algom Limited continued to retain a significant ground position in the East Kemptville area with ongoing exploration projects. This year Granges Exploration initiated an exploration program for tin and tungsten in southwestern Nova Scotia, and Acadia Mineral Ventures have continued several projects in the Yarmouth County area.

Exploration for copper, lead, zinc and associated metals continued at reduced levels as compared to previous years. Bigstone Minerals Limited carried out additional work on the Stirling property in Richmond County and BP Resources Canada Limited continued several small projects in northeastern mainland Nova Scotia and Inverness County.

Noranda Exploration Company Limited and the Scotia Mineral Exploration Venture (Scominex) group have carried out reconnaissance gold and base metal evaluations in several areas in eastern Nova Scotia.

Durham Resources Incorporated initiated a detailed surface exploration program on their antimony property at West Gore, Hants County and are currently carrying out a diamond-drilling program.

Gold

Exploration for gold was carried out primarily by junior companies working in the Meguma Group rocks of Halifax and Guysborough Counties. Several programs were continued from 1984, and include detailed geochemical and geophysical surveys, trenching and diamond-drilling.

Seabright Resources Incorporated continued a large-scale exploration program, consisting of detailed surface work and diamond-drilling, on the Forest Hill property in Guysborough County. Earlier in the year, the company announced a significant gold discovery on the property and is proceeding to an initial development phase. Seabright also continued a detailed feasibility study on recovering gold from old tailings sites throughout the Province and is currently carrying out a large diamond-drilling program at Lake Catcha, Halifax County.

Pan East Resources Incorporated resumed work on several gold properties and is carrying out an extensive drilling program on the Fifteen Mile Stream property north of Sheet Harbour in Halifax County and two small drilling programs at Killag Mines, Halifax County and Mount Uniacke, Hants County. Northumberland Mines (under Scominex funding) carried out detailed diamond-drilling on the Cochrane Hill and Goldenville properties near Sherbrooke in Guysborough County.

Other drilling programs were undertaken by Scominex at Molega, Onitap Resources Incorporated at Isaacs Harbour, Durham Resources Incorporated at Wine Harbour and Acadian Gold Mines Limited at Beaver Dam. Surface exploration programs were done by Coxheath Gold Holdings Limited at Gold River near Chester Basin and Mile Lake just west of Seabright's Forest Hill property. Jascan Resources Incorporated initiated detailed surface work on the Scraggy Lake (Gold Lake) property just east of Lake Charlotte.

Attention continues to be focused on the gold potential of the volcano-sedimentary rocks of the Cape Breton Highlands in Inverness County. BP Resources Canada Limited recently completed a small drilling program for gold and base metals near Cheticamp, and Gold Brook Developments Limited carried out surface exploration on properties in the area. Noranda Exploration Company Limited and the Scominex group have also carried out a reconnaissance gold and base metal evaluation of the Highlands area.

Underground exploration was carried out by Gold Brook Developments Limited on the Second Brook property at Middle River and E. Horne continued underground work on the Free Claim zone at Renfrew. Meguma Gold Corporation Limited are also continuing an evaluation of the Leipsigate property west of Bridgewater.

MINING DEVELOPMENT

Development work on the East Kemptville tin deposit, owned by Rio Algom Limited, has continued on schedule and initial production from the open pit mine was started in mid-October. The mine is expected to operate at 9 000 tpd at full capacity with an annual output of approximately 3.3 million tons of ore. Mineable reserves are estimated at 56 million tons grading 0.16% tin, with copper and zinc as by-products.

Seabright Resources Incorporated are nearing the development phase of the recently discovered significant gold reserves at the Forest Hill property in Guysborough County. The company is currently preparing for a detailed underground exploration program and has recently announced the awarding of a $3 million contract to Cementation Company (Canada) Limited for the construction of an 850-foot shaft to facilitate an underground evaluation of the property prior to future development work.

INDUSTRIAL MINERALS*

John H. Fowler

As part of the Canada-Nova Scotia Mineral Development Agreement, the Nova Scotia Department of Mines and Energy, and Energy, Mines and Resources, Canada initiated several industrial mineral programs designed to stimulate mineral development in Nova Scotia. These programs include commodity market studies, mineral technology programs, and resource evaluation and documentation projects. Because of similar mineral development agreements with two other Atlantic Provinces (i.e. Canada - New Brunswick and Canada - Newfoundland) the market studies are regional in scope.

MINERAL DEVELOPMENT AGREEMENT PROGRAMS

Resource Studies - Nova Scotia Department of Mines and Energy

1. Building Stone. Mr. Gordon Dickie was hired on September 3, 1985 to begin a five year study on Building Stone Resources of Nova Scotia. To date, most sandstone quarries in Cumberland, Pictou and Inverness Counties have been located and evaluation has commenced. All stone producers in Nova Scotia have been contacted to discuss their stone requirements. Time was spent locating the source of dimension stone used in the construction of the Art Gallery of Nova Scotia building on Hollis Street.

2. Gypsum and Anhydrite Deposits of Nova Scotia. On June 17, 1985 Mr. Gordon Adams began a project to produce a report, with maps, on gypsum and anhydrite deposits in Nova Scotia. To date, all gypsum and anhydrite producers in the Province have been contacted and the objectives of the product presented to them. Research and compilation of all gypsum and anhydrite data is continuing, and contact has been established with those doing research on additional uses for gypsum and anhydrite. An information package to be used as a basis for a brochure on the gypsum and anhydrite industry in Nova Scotia is in progress.

3. Aggregate Resources of Cape Breton. Two-colour, granular aggregate resource maps of Cape Breton Island have been published and are now available from the Nova Scotia Department of Mines and Energy (Maps 85-3, 85-4, 85-5 and 85-6). Three maps locate and describe the deposits, and the fourth map identifies pits and quarries throughout Cape Breton Island.

Market Studies - Nova Scotia Department of Mines and Energy

1. A study of current market economics of strontium compounds was completed by Metals Economics Group of Halifax, Nova Scotia and Boulder, Colorado and is available as Open File Report 648.

2. A feasibility study on the establishment of a gypsum wallboard plant in Nova Scotia is being prepared for the Nova Scotia Department

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*Some projects funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement. Some projects funded by the Mineral Policy Sector and Canmet of Energy Mines and Resources, Canada under the Canada - Nova Scotia Mineral Development Agreement of Mines and Energy by the Centre for Resource Studies, Queens University, Kingston, Ontario.

Market Studies - Mineral Policy Sector, Energy Mines and Resources, Canada

The following market studies are in progress through contracts awarded by the Department of Supply and Services Canada. All reports when completed, will become public documents.

1. Market Analysis for Nova Scotia, New Brunswick and Newfoundland Dimension Stone. This study examines markets for building stone within reach of Nova Scotia, New Brunswick and Newfoundland. The contract was awarded to the DPA Group Incorporated.

2. Aggregate Materials Accessible from Nova Scotia and New Brunswick. This study identifies markets for aggregates beyond the geographical boundaries of New Brunswick and Nova Scotia. The contract was awarded to ADI Limited, Fredericton, New Brunswick.

3. An Industry Study of Industrial Minerals used in Oil and Gas Exploration on the Eastern Canadian Offshore. The study identifies the various minerals and quantities of each of the industrial minerals used in offshore drilling operations. The contract for this study was awarded to Jacques, Whitford and Associates Limited. Provincial participation includes Newfoundland, Nova Scotia and New Brunswick.

4. Silica and Silica Sands Accessible from Nova Scotia and New Brunswick. The study identifies markets and specifications for silica and silica sand outside the Province but within market range. The contract has been awarded to ADI Limited, Fredericton, New Brunswick.

Mineral Technology Studies - Canmet, Energy Mines and Resources, Canada

These studies are in progress through contracts awarded by Supply and Services Canada and will become public documents upon completion.

1. Development of Engineering Data on Nova Scotia Fly Ash. This study will provide comprehensive engineering data to identify more extensive uses of fly ash in the concrete industry. The contract for this study was awarded to L. E. Shaw Limited.

2. Nova Scotia Silica Study. This is a detailed study on Nova Scotia silica deposits to identify beneficiation and processing procedures that could upgrade the product thereby creating additional marketing opportunities. The study is being done by Fenco Shawinigan Engineering Limited.

3. Nova Scotia Barite Study (Deposits, Development, Markets). A study on barite deposits in Nova Scotia to identify required beneficiation procedures, market situations and ability of Nova Scotia producers to gain entry into additional markets. The contract for this study was awarded to Jacques, Whitford and Associates Limited.

MINERAL INVENTORY

N. A. Lyttle

GEOSCAN ACTIVITIES

Indexing and on-line data entry into GEOSCAN, the national bibliographic database for geological information, continued throughout 1985 for Nova Scotia Department of Mines and Energy assessment reports, publications, open file reports and open file maps, and geoscience theses and journal literature. As of September 30, 1985, the database contained 7,563 Nova Scotia Department of Mines and Energy records, consisting of: 3,713 assessment reports; 1,574 publications; 1,058 journal literature references; 585 open file reports; 593 theses; and 40 open file maps. *Report 85-2 Index to Assessment Reports 1984 (with Keyword Index), and Report 85-3 Index to Publications, Open File Reports and Open File Maps for 1984 (with Keyword Index)* were released in May 1985. New five-year indexes, for the years 1981 to 1985, for assessment reports, and publications, open file reports, open file maps and theses, will be published in 1986.

GEOSCAN Petroleum Exploration Assessment Reports Project*
(M. J. Fraser-MacKinnon)

This project started in May 1984, and ended on March 31, 1985. Ninety-one onshore petroleum assessment reports and 270 offshore petroleum well reports, received by the Nova Scotia Department of Mines and Energy between 1968 and 1984, were organized, indexed and entered into GEOSCAN. Twenty-two of the 91 onshore reports are non-confidential, have been microfilmed, and are publically accessible in the Department libraries in Halifax and Stellarton. One hundred and nineteen of the 270 offshore reports are non-confidential and can be consulted in hard copy in the Petroleum Resources Section of the Department or obtained on microfiche from COGLA in Ottawa.

GEOSCAN Journal Literature Project* (G. Frotten)

This project started in January 1984, and ended on March 31, 1985. A total of 1,398 journal literature references on the geoscience of Nova Scotia have been identified. Seven hundred and sixty have been indexed and entered into GEOSCAN. In addition, a hard copy of each of the 760 indexed references has been obtained and is filed alphabetically by author in the Halifax library of the Department.

GEOSCAN Records Standardization Project* (D. Wilkinson)

Participating agencies have been converting and standardizing their GEOSCAN records to facilitate compatibility and searching of the database as part of the preparations involved in making GEOSCAN publically accessible through commercial vendors of on-line databases. The conversion and standardization of Nova Scotia GEOSCAN records started in January 1984, and as of September 30, 1985, 3,970 records had been processed.

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*Funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement

GEOSCAN Theses Project* (D. R. MacDonald)

A total of 111 B.Sc., M.Sc and Ph.D. geoscience theses on Nova Scotia produced between 1981 and 1985, and 47 pre-1981 theses have been identified, indexed, entered into GEOSCAN and microfilmed. To date, 593 geoscience theses have been entered into GEOSCAN and 528 of these can be consulted on microfiche in the Halifax library of the Department. Author and NTS indexes to the newly identified theses will be published in 1986 as part of the new five-year publications index. Indexes to pre-1981 theses were previously published in Report 81-6. *Open File Map 85-01 Nova Scotia Thesis Study Area Location Map* will also be published in 1986.

GEOSCAN Data Entry Project* (J. Newman)

This project started in January 1984 and ended on March 31, 1985. As of March 31, 1985, the following records had been entered on-line into the GEOSCAN data base: 606 assessment reports; 104 open file reports; 20 open file maps; 192 publications; 129 theses; 536 journal literature references; and 3,484 converted records.

GEOSCAN Mining Engineering Reports Project* (G. Frotten)

This project, which started in April 1985, involves the identification, sorting, indexing and microfilming of technical reports received by the Mining Engineering Division from private industry over the past ten years. A total of 158 reports have been identified and indexed, the majority of which are concerned with feasibility and environmental impact studies on proposed coal and base metal mine development operations in Nova Scotia. Seventy-five of these reports are non-confidential and have been microfilmed. These open reports were released in the September 1985 open assessment reports list, and they can be consulted on microfiche in the Halifax and Stellarton libraries of the Department.

GOLD BIBLIOGRAPHY (J. Gillespie-Wood)

Compilation of information for the gold bibliography, to be entitled *Gold in Nova Scotia: a Bibliography of the Geology, and Exploration and Mining Histories from 1832 to 1985*, is well advanced and publication is expected in 1986. The bibliography, over 500 pages in length, will contain over 1,300 references, documenting 265 gold districts and occurrences. The bibliography will be organized into three parts: Part I will be an alphabetic author index; Part II will be an index by gold district, with each gold district being subdivided into an author index, an assessment reports index and a map and cross-section index; Part III will contain the following cross reference lists - gold district/ NTS map/county, NTS map/gold district/county and county/gold district/NTS map.

GOLD PAMPHLET* (J. Bates)

In co-operation with the Public Awareness group, a pamphlet entitled *Gold in Nova Scotia* has been written, and will be published in 1986. The pamphlet, which is written in a nontechnical manner, is intended for the general public and school students. The pamphlet contains information on the history of gold mining in Nova Scotia, the mining and extraction of gold, the occurrence and distribution of gold in Nova Scotia, the geology and origin of gold deposits in Nova Scotia, and present and future trends in gold exploration. A map of Nova Scotia illustrating the basic geology, and the location of gold districts and producers is included. In addition, the pamphlet contains production figures of the gold districts according to regions, an Information/Do-It-Yourself section, a listing of gold festivals and related events, a listing of related continuing education courses on introductory geology and prospecting, a listing of selected references and a glossary of geological terms.

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*Funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement

MINERAL OCCURRENCES DATABASE PROJECT* (G. DeMont, M. Ponsford)

Information from the metallic and industrial mineral occurrences data card files, compiled up to 1980, have been computerized to form two mineral occurrences databases. The metallic mineral occurrences database consists of information on 894 mineral occurrences, recorded in 27 data fields. The industrial mineral occurrences database consists of information on 1,042 mineral occurrences, recorded in 20 data fields.

The databases can be searched on individual data fields or any combination of data fields and the search results printed out at a computer terminal. In addition, map plots of mineral occurrence locations can be obtained at any requested scale. At present, the mineral occurrences databases are supported at the Maritime Resource Management Service (MRMS) in Amherst, where they can be accessed on a fee-for-service basis.

Open File Reports 599, 600 and 601 Metallic Mineral Occurrences Maps and Data Compilations, Open File Reports 606, 607, and 608 Industrial Mineral Occurrences Maps and Data Compilations were released, respectively, in December 1984 and June 1985. Each of these reports consists of a 1:250 000 scale mineral occurrences location map plotted on a geological base, together with data tabulations on the mineral occurrences obtained from the mineral occurrences databases, compiled up to 1980.

DRILLHOLE DATABASE PROJECT* (G. Demont, A. McIntyre)

As of September 30, 1985, all the open assessment reports up to the end of 1984 had been coded for the 31 data fields which constitute the drillhole database. This represents approximately 11,000 drillholes from 1,874 assessment reports.

The database can be searched on individual data fields or any combination of data fields and the search results printed out at a computer terminal. In addition, map plots of drillhole locations can be obtained at any requested scale. At present, the drillhole database is supported at the Maritime Resource Management Service (MRMS) in Amherst, where it can be accessed on a fee-for-service basis.

Assessment reports which become open during 1985 are presently being coded for drillhole data. When this coding is completed, an open file report will be published in 1986 that contains a listing of all drillholes from all open assessment reports with data tabulations from the drillholes database.

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GOLD COMMODITY STUDY*

C. Miller

A Canada - Nova Scotia Mineral Development Agreement project was implemented in December 1984 to undertake a comprehensive review and compilation, from existing resource material, of the distribution and character of gold mineralization in Nova Scotia. A gold bibliography compiled by Janet Gillespie-Wood of the Mineral Inventory group of Nova Scotia Department of Mines and Energy serves as the basic reference work for this research.

In the first nine months of research some 30 per cent of the approximately 2 000 available government reports, company reports, theses and newspaper articles have been reviewed. Research has been completed for the period 1860 to 1910 inclusive. A number of references to gold occurrences, not documented in standard reference works, will be examined in phase two of this project.

Detailed mapping of known and well documented gold properties is not planned. However, certain areas, that may have potential or were mentioned in reports to have the presence of gold, will be investigated. Localized mapping, diamond-drilling and precious metal analyses will be undertaken in less well-known areas during the second phase of this project.

To date (October 1985) two diamond-drill holes totalling 700 metres have been completed near Sinclair Lake south of Goldenville, Guysborough County. This drilling was undertaken to assess the coincidence of airborne geophysical anomalies and the westward extension of the Wine Harbour anticline. Visual examination of this core yielded less quartz veining than anticipated. Comparison of the geophysical signatures at this area with other geophysical anomalies is expected to be very useful as new drill targets are identified.

REFERENCE

Gillespie-Wood, J.
in prep: Gold in Nova Scotia: a bibliography of the geology, and mining history and exploration from 1832 to 1985; Nova Scotia Department of Mines and Energy, Report in preparation.

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*Funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement

MINERAL AND ENERGY LAND USE PROJECT*

D. B. Hopper

INTRODUCTION

In June 1983 a new Planning Act for Nova Scotia was ratified by the Legislature. The Act enables the Province to prepare provincial land use policies whose intent shall be embodied within planning stratagies at the municipal level. The Nova Scotia Department of Mines and Energy recognizes its obligations in forming land use policies to provide responsible management and protection of the Province's mineral and energy resources.

Under the new Canada - Nova Scotia Mineral Development Agreement, the Department has initiated a land use planning project which will provide a comprehensive database to support a provincial mineral land use policy.

The land use planning project will make available, in a useable form, information on Nova Scotia's past, known and potential mineral wealth to other land users, such as cities, townships, rural municipalities and counties, outdoor clubs and societies, and voluntary planning organizations.

GOAL AND OBJECTIVES

The overall goal of the project is to ensure the protection, conservation and proper management of the Province's earth resources.

The objectives to realize the goal have been identified as follows:

1. To provide information and general direction with respect to mineral and energy resource lands.

2. To ensure the Province's earth resources are available for exploration and development.

3. To identify land use planning issues associated with mineral and energy resource lands.

4. To provide information and to identify consultative approaches that will provide for the full consideration of mineral and energy assessment in the land use decision-making process.

5. To provide regional maps showing mineral potential.

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*Funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement

A PHASED APPROACH

The project will be carried out in three phases over a five year period. Each phase will produce supporting material and mapped information for mineral land use policy for the Province.

Phase 1: Information Base

A systematic collection of existing geoscientific and industry-related information is in progress. The data will be organized according to the Province's twenty-four rural municipalities. The result, a Mineral and Energy Land Use Handbook Series will benefit the municipalities.

Each Handbook will have two main components. There will be a set of mineral resource/land use (MRLU) maps assembled at the 1:50 000 scale, and organized sets of data and text providing further description to the mapped information. The MRLU maps show: mineral, sand and gravel, and peatland occurrences; coal resources; areas of potential subsidence; mines, pits and quarry locations; shaft and adit locations, drillhole locations and so on.

The second component to the Handbook includes: an annotated bibliography; mineral and energy exploration and development statistics; exploration and mining histories; past and present mine and quarry plans; case histories of land use conflicts arising from mineral and energy land use as well as a list of contacts available within the Nova Scotia Department of Mines and Energy.

Phase 2: Mineral Potential Maps

A natural progression from the MRLU map series is to use all systematically collected data, from phase 1 and Departmental files, publications and maps, toward the assemblage of a mineral potential map series for Nova Scotia. An easily understood rating system will be developed to evaluate the mineral exploration and development potential of the Province's regions.

Phase 3: A Provincial Mineral Land Use Policy

Once a comprehensive mineral and energy land use database, which can be easily updated and refined, is in place, a land use policy for the Province can be formulated.

The Department's primary concern is the provision of geoscientific information to encourage future development of the mineral and energy industry in Nova Scotia. This range of concern includes furnishing provincial and regional planners and other land users with useful, current geoscientific information. Indeed it is in the Province's best interest to encourage the dissemination and use of geoscientific resource information in the land use planning process.

GEOCHRONOLOGICAL CONSTRAINTS FOR MINERALIZATION IN THE EASTERNMOST MEGUMA TERRANE, NOVA SCOTIA*

J. D. Keppie, R. D. Dallmeyer[1], T. E. Krogh[2],
R. F. Cormier[3] and A. N. Halliday[4],

The easternmost Meguma Terrane comprises a lower unit of variably metamorphosed sandy turbidites of the Goldenville Formation which is conformably overlain by pelitic rocks of the Halifax Formation (Table 1). Two distinct populations of detrital zircons in the Goldenville Formation yield U/Pb ages 1945-2685 Ma and 580 - 602 Ma. Detrital sphene yields c.580 Ma U/Pb ages. Detrital cassiterite in the Goldenville Formation probably has a similar aged (?) amphibolite facies and this may also apply to gold. The younger ages provide a lower constraint on the age of the Goldenville Formation. An upper limit is provided by the Tremadocian graptolites and achritarchs in the Halifax Formation.

During the Early Devonian, major subhorizontal east-west folds associated with a penetrative cleavage were produced by sinistral shear deformation. ^{40}Ar/^{39}Ar incremental release age spectra of whole rock slate/phyllite samples range between 384 and 407 Ma, and are interpreted to closely date this event. Auriferous stratabound veins, radial veins in fold hinges and en echelon veins in fold limbs formed continuously throughout this event apparently by pressure solution and transfer with precipitation in low pressure zones. Local geochemical factors likely controlled the elements precipitated.

Westward obduction of the Meguma Terrane, bounded on the northern margin by the dextral Minas Geofracture, was initiated in the Late Devonian. This was accompanied by granitic plutonism, regional formation of associated low pressure contact metamorphism and local development of ductile shear zones. U/Pb ages of monazite and zircon from the plutons indicate intrusion at c.373 Ma. ^{40}Ar/^{39}Ar plateau ages for muscovite and biotite from these plutons range from 360 - 372 Ma, and indicate relative rapid cooling of high level plutons and contact aureoles. ^{40}Ar/^{39}Ar plateau ages in the range of 363 - 373 Ma, on dynamically recrystallized muscovite and biotite from dextral shear zones adjacent to the Minas Geofracture, suggest ductile deformation occurred during to shortly after plutonic emplacement and porphyroblastic growth in the aureole. Rb-Sr whole rock isochron ages from the same plutons range from 365 to 405 Ma, suggesting crustal contamination for the older ages and hydrothermal alteration for the youngest ages. Sn-W-U-Be-B mineralization is associated with plutonism. On the other hand, gold was mobilized within the garnet and higher grade portions of the contact metamorphic aureoles, and appears to have migrated into dextral shear zones during cooling (e.g. Cochrane Hill, Mile Lake, Forest Hill).

The last major deformation event resulted in northwest-southeast sinistral faulting and formation of kink bands (e.g. Country Harbour Fault). This activity is likely Mesozoic age and associated with the opening of the Atlantic Ocean. Remobilization of gold into tension gashes associated with fault/kink zones, appears to have occurred locally, (e.g. Widow Point).

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Table 1. Geological history of the Easternmost Meguma Terrane.

TIME	SCALE	DEFORMATION EVENT	FABRIC	GEOLOGICAL RECORD	AGES	VEIN TYPES	ECONOMIC GEOLOGY	TECTONIC INTERPRETATION
			F_5	Dextral and sinistral, north-south shear fracture zones. East-west, gently dipping conjugate kink bands				
245	(?)EARLY MESOZOIC	Atlantic Phase (GLOOSCAP)	F_4	Northwest-southeast, sinistral, strike-slip, brittle-ductile faults, rare conjugate northeast-southwest dextral faults; both associated with kink bands and devitrified pseudotachylite		En echelon tension gashes in kink bands	Sometimes auriferous (e.g. (?)Widow Point)	Opening of Bay of Fundy Rift, Birth of the Atlantic Ocean
286 333	PERMIAN LATE CARBONIFEROUS	LATE ALLEGHANIAN		Deposition of Canso-Pictou Group accompanied by folding (of Carboniferous rocks) and east-west dextral faulting		Late discordant and concordant veins	Sometimes auriferous ± sulphides and specularite (e.g. Lower Seal Harbour)	Deformation of Magdalen Basin during final amalgamation of Pangea
360	EARLY CARBONIFEROUS			Deposition of Horton and Windsor Groups in central Meguma terrane during dextral shear. Erosion of Meguma Group and deformed granites.				Formation and filling of Magdalen Pull-apart Fareland Basin
	LATE DEVONIAN	EARLY ALLEGHANIAN	F_3, S_3	Regionally inhomogeneous, east-west, dextral, ductile deformation zones: transposition and rotation of ac veins and porphyroblasts ± foliation-blasto-mylonite + sheath folds + C-S fabrics. Biotite and muscovite recrystallize dynamically	$^{40}Ar/^{39}Ar$ = 359 - 373 ± 2 Ma on biotite and muscovite	Veins parallel to fold axial planes. Veins develop in plane of extensive and rotate into shear plane	Remobilization of Au into dextral shear zones (e.g. Forest Hill, Mile Lake, Country Harbour, Cochrane Hill)	approximately 370 - 4745 km of dextral movement on Minas Geofracture on northern side of Meguma Allochthon
				S-type granitoid plutonism and associated Pyreneean metamorphism: biotite, garnet, staurolite, andalusite, cordierite	$^{40}Ar/^{39}Ar$ = 360 -372 ± 2 Ma on biotite and muscovite Rb/Sr WRI = 364 - 407 ± 10 Ma U/Pb monazite = 374 ± 2 Ma	Crosscutting veins and pegmatoids	Au absorbed into Sn-W-Mo-U-Be granite; Au driven off in amphibolite facies	
374			F_2, S_2	Subhorizontal crenulation cleavage and metamorphic banding. Biotite and muscovite recrystallize				
387 408	MIDDLE DEVONIAN EARLY DEVONIAN	LATE ACADIAN	F_1, S_1 (S_s) Fe	Sub-horizontal, east-west folds, pressure solution, grain alignment foliation and slaty cleavage produced by sinistral shear and subhorizontal extension. Chlorite, muscovite, biotite recrystallize. Early northwest-southeast folds, Fe.	$^{40}Ar/^{39}Ar$ = 384 - 407 ± 5 Ma (whole rock slates)	Stratabound Saddle reef and radial veins in fold hinges; en echelon angler veins in fold limbs; veins in sinistral shear zones	Au into conical or tight fold hinges, or both, (e.g. Goldenville, Isaacs Harbour and Wine Harbour) and shear zones (e.g. Wines and Seal Harbour)	Accretion of Avalon and North America
438 458	SILURIAN LATE ORDOVICIAN			Deposition of Torbrook-White Rock Formations in northwest Meguma Terrane	Fossiliferous: [(?)Caradocian] Ludlovian-Siegenian [-(?)early Emsian]			Formation and filling of Yarmouth Rift
478	MIDDLE ORDOVICIAN EARLY ORDOVICIAN			DEPOSITION of HALIFAX FM. Andalusite schist Graphitic schist Quartzite/schist Coticule unit Semipelitic schist	Tremadocian [and(?) Arenigian] graptolites and achritarchs Upper intercept $^{40}Ar/^{39}Ar$ = 467 ± 2 Ma			Deposition on a micro-continental submarine plateau
505 570	CAMBRIAN		F_1 S_a S_0, F_0	GOLDENVILLE FM. Interbedded sandy turbidites and slates and siltstones Sliding, slumping and compaction: diagenesis Syndepositional structures	K-Ar age on (?)detrital muscovite = 485 - 506 ± 20 Ma		Possible source of gold in metal rich layers or disseminated throughout	Deposition in an intradeep during transpression following Late Precambrian orogenies
	PRE-CAMBRIAN			Continental Crust				

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[1] University of Georgia, Athens, Georgia, United States of America
[2] Royal Ontario Museum, Toronto, Ontario
[3] St. Francis Xavier University, Antigonish, Nova Scotia
[4] Scottish Universities Research and Reactor Centre, Glasgow, Scotland

CUMBERLAND BASIN PROJECT - A PROGRESS REPORT*

R. C. Boehner, R. J. Ryan and D. C. Carter

INTRODUCTION

The Cumberland Basin (Synclinorium) is the largest (3600 km^2) and deepest (7000 m+) Carboniferous structural basin in Nova Scotia (Fig. 1). It contains predominantly fine- and coarse-grained alluvial-fluvial continental clastics with major evaporitic-marine rocks. This complex succession of Tournaisian to Stephanian age was deposited to the north of the Cobequid Highlands subsequent to the Acadian Orogeny.

The area has a long history of coal and salt mining, as well as, building stone production. In addition, it contains numerous sediment-hosted metallic mineral occurrences or prospects (Cu-Pb-Zn-Ag-U), and industrial - nonmetallic mineral occurrences or prospects such as barite, celestite, salt, potash and limestone.

The principal goal of the project is to develop a comprehensive understanding of the stratigraphy, sedimentology, structure, economic geology and history of development of the area. This study will be fundamental in evaluating its mineral resource potential. To this end the major activities by the project staff include (1) basin geology and sedimentology, etc. by R. Ryan and R. Boehner (this volume); (2) special emphasis on Windsor Group evaporite geology including a drilling program and mapping of the Pugwash Mine by D. C. Carter (this volume).

GENERAL GEOLOGY

The Cumberland Basin (Synclinorium) has a prominent east-west trend parallel to the Cobequid Highlands (Fig. 2). It forms a western arm or extension of the larger Magdalen (Fundy) Basin of Wade et al. (1977) centred beneath the Gulf of St. Lawrence located to the northeast.

The intrabasin structure also reflects the east-west trend and has the general configuration of a synclinorium with two internal en echelon diapiric anticlinal structures termed the Claremont (Malagash) and Minudie Anticlines (Fig. 2). Within the intervening Wallace Syncline there are several isolated evaporite cored diapiric structures. Major synclines include the Athol and Tatamagouche (locally doubly plunging) Synclines and the Dorches Syncline that extend from the New Brunswick border to the north of the Minudie Anticline. The east-west folding is locally complicated by subparallel longitudinal faults and transverse faults with similar orientations to the Glooscap Fault - Minas Geofracture System. The nature of these major Faults in the dip subsurface is not clear.

Field activities in 1985 were focused on the extension of mapping from the Tatamagouche Syncline area (Ryan, 1985**) northward across the

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*Funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement

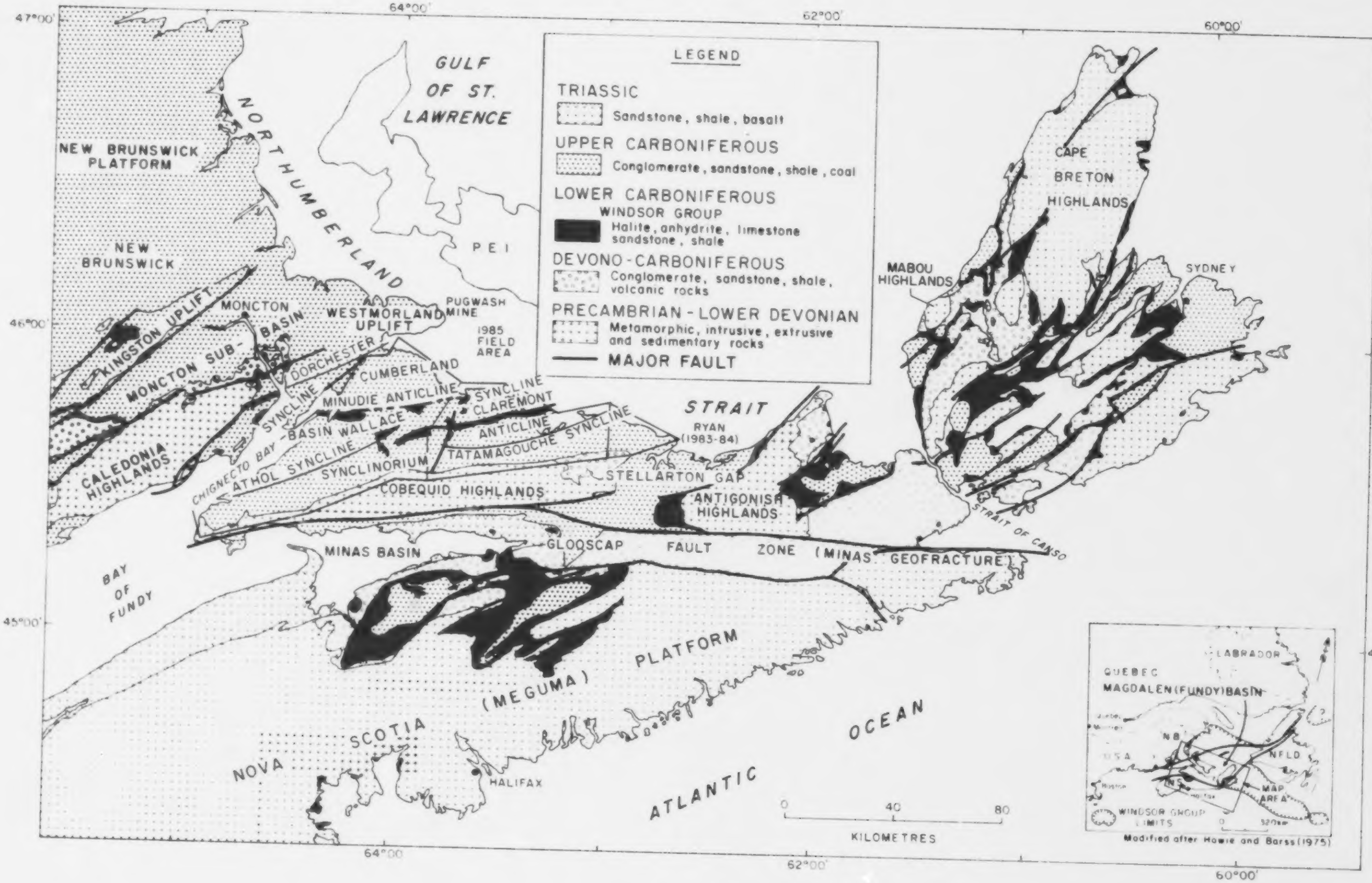

Figure 1. Location map

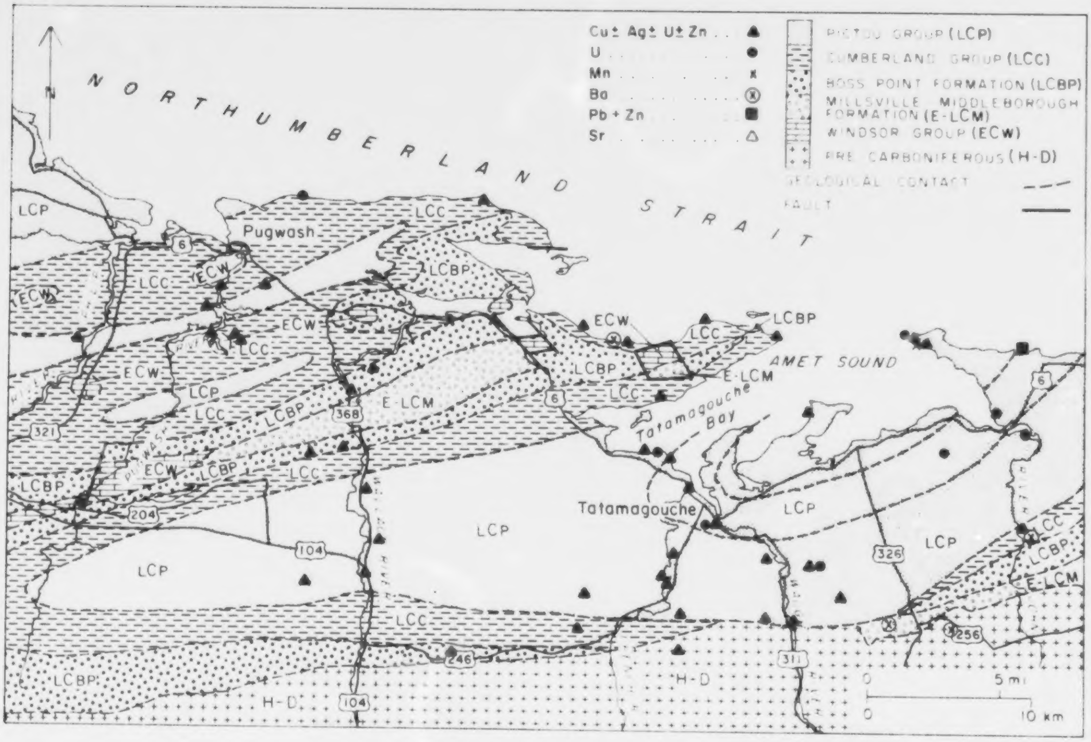

Figure 2. Geological map and mineral deposits of the eastern part of the Cumberland Basin, Nova Scotia.

east part of the Claremont (Malagash) Anticline (Figs. 1 and 2). Preliminary results from this field activity and mapping in the Pugwash mines are summarized in the two following papers of this volume.

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CUMBERLAND BASIN GEOLOGY*

R. J. Ryan and R. C. Boehner

INTRODUCTION AND STRATIGRAPHY

The upper Carboniferous strata of the northeastern part of the Cumberland Basin comprise red and grey conglomerates, sandstones and mudstones with major limestones and coals. The strata are predominantly continental fluvial in origin. Laterally extensive thin limestones, coals and liquefaction sandstone beds are valuable as markers and facilitate correlation within the northeastern Cumberland Basin area.

The Carboniferous strata are tentatively divided into the following informal units (Fig. 1): Windsor Group (undivided), Canso Group (undivided fine facies), Millsville-Middleborough Formation, Boss Point Formation, Cumberland coarse facies, Cumberland fine-Pictou grey beds, and the Pictou lower red beds. Formal lithostratigraphic nomenclature will be introduced when the mapping and subsurface analysis is sufficiently Leave 32 lines for Fig. 1.

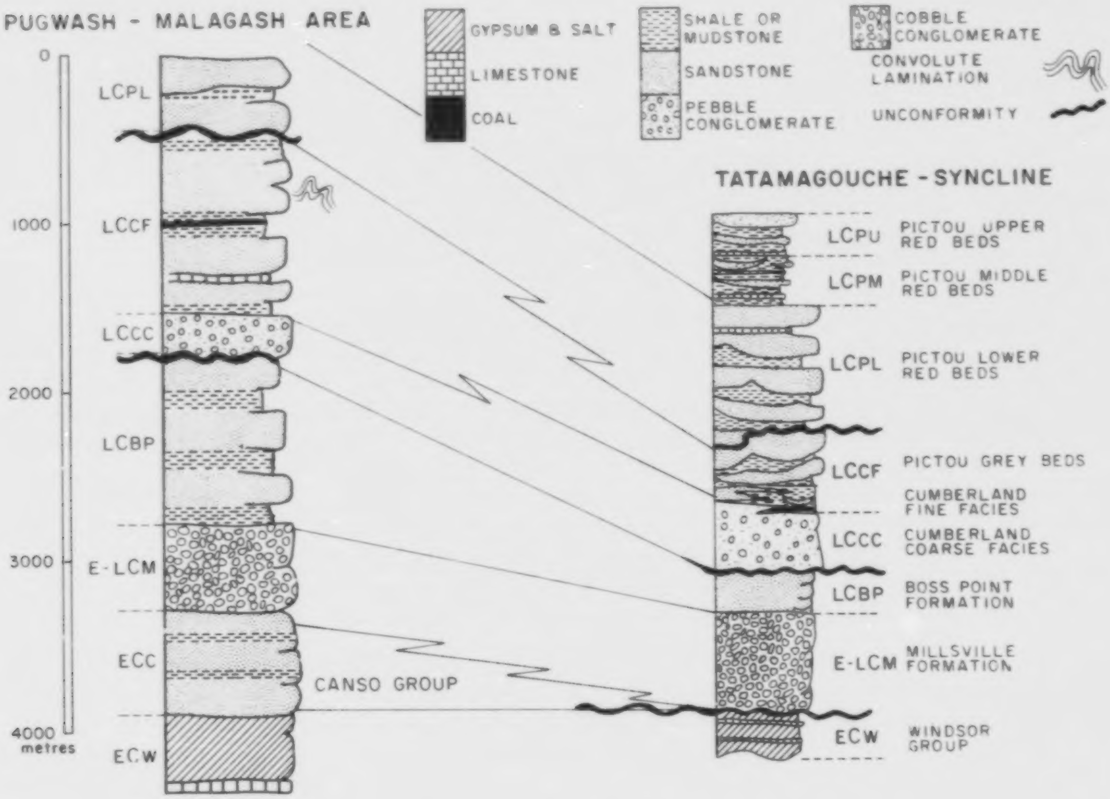

Figure 1. Stratigraphic correlation diagram of the eastern part of the Cumberland Basin.

advanced and map units finalized. Correlation of these units in the 1985 study area with the strata of the Tatamagouche Syncline area (Ryan, 1985) is possible with the most significant difference being the occurrence of the undivided fine grained Canso Group and the limited representation of the Pictou Group in the Pugwash-Malagash area (Fig. 1).

The Cumberland fine facies (Bell, 1944) and the Pictou grey beds (Ryan, 1985) of Westphalian C age, are lithologically similar and are therefore considered as one lithostratigraphic unit. The recognition of the Cumberland fine facies north of the Claremont Anticline (Fig. 1; Figs. 1 and 2 of Boehner, Ryan and Carter, this volume) greatly expands the area of potential economic coal occurrences within the Cumberland Basin (Synclinorium).

SEDIMENT DISPERSAL PATTERNS

Dispersal patterns within the strata of the 1985 field area trend to the north-northeast at approximately 020°. This northeastward direction is consistent with the regional dispersal patterns but is discordant with the northwestward trend found within the Upper Carboniferous rocks of the Tatamagouche area (Ryan, 1985), suggesting different flow patterns were simultaneously active on either side of the Claremont diapiric Anticline.

Paleocurrents in the Cumberland and Pictou Groups trend away from the Claremont diapiric Anticline suggesting a syndepositional development of this structure. In contrast, the domes such as Pugwash and Beckwith (along with extension of the Minudie Anticline trend) exhibit little proximal dispersal pattern variance indicating the evaporite domes probably postdate the sedimentation in these areas.

ECONOMIC GEOLOGY

The mineral occurrences in the 1985 field area (Fig. 1) can be classified into several types: (1) basinal Cu, Pb, Zn, Ag, V red bed occurrences of diagenetic origin found proximal to reduction zones related to coalified plant material in channel log sandstones; (2) fault-fracture related occurrences such as celestite and barite veins. In addition, potential (but as yet undocumented) exploration environments may include: (3) fault-fracture related Cu, Pb, Zn, Ag epigenetic mineralization; (4) onlap-unconformity mineralization such as (a) grey sandstone onlap to basement (possible Yava type) Pb, Zn, Ag, U; (b) unconformity of organic-rich grey sedimentary rocks on a thick red bed succession (Kupferschiefer (redox) type) giving rise to U, Cu, Pb, Zn, Ag mineralization.

Also noteworthy is the proximity of mineral occurrences to the Windsor Group evaporite structures. This association may have a genetic nature as suggested by Dunsmore (1977) or may reflect influence of the structural exposure of stratabound mineralization.

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GEOLOGY OF THE PUGWASH MINE - A PROGRESS REPORT*

D. C. Carter

INTRODUCTION

The Canada Salt Company began producing salt at Pugwash, Nova Scotia (Figs. 1 and 2 of Boehner, Ryan and Carter, this volume) in 1959 following the closure of the Malagash, Nova Scotia mine in the same year. Interpretation of the initial drilling at Pugwash suggested a simple flat-lying salt deposit. However, production work very quickly revealed that the deposit was a complex series of steeply dipping anhydrite units interstratified with halite. The anhydrite units are isolated in a matrix of halite by boudin development. Within the evaporite sequence, bedding dips from 30° ('flat lying') to sub-vertical.

PREVIOUS WORK

Published geological reports on the Pugwash mine have been limited to the 630 foot level workings (Evans, 1972; Goodman, 1985). Evans discussed the origin and lithology of the anhydrite, and the stratigraphy and geometry of what was interpreted to be a complex salt diapir. These findings were based on 630 foot level workings available at the time. Subsequently, mining on the 630 level has been completed and production is now from the 830 and 730 foot levels. Investigations from the latter levels, have not been attempted prior to this study.

GEOLOGICAL INVESTIGATIONS

Field work during 1985 focused on the 830 level with (1) detailed logging and sampling of over 100 development core holes (100-1200 feet in length) and (2) preliminary mapping of the workings. This work has indicated that, although the evaporites are structurally complex, individual anhydrites and ultimately the intervening halite units can be identified and correlated (Fig. 1). There are two or possibly three lithologically distinct anhydrite members exposed in the 830 level workings. This is consistent with the work of Evans (1972) but in contrast with the ten units suggested by Goodman (1985). The two recognizable members (ranging 15-30 m in thickness) have been termed informally the main anhydrite and the borate anhydrite (Fig. 1). There is possibly a third anhydrite member which does not exhibit internal markers. However, it is suspected that further detailed investigations will identify the currently unnamed anhydrite units as fragments of one of the above.

The potash (carnallite and sylvite)-bearing halite and mudstone present on the 830 level probably occur within an upper stratigraphic portion of the evaporite sequence, as exposed in the present workings. This interpretation contrasts with the formerly postulated lower position and secondary origin implied by Evans (1972). This preliminary suggestion will be the subject of additional detailed mapping and geochemical profiling.

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*Funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement

Geological and geochemical data will be significant to the understanding of the stratigraphic and structural complexities of this particular deposit, and will inturn be applicable to other evaporite sequences and potentially mineable deposits identified by exploration drilling.

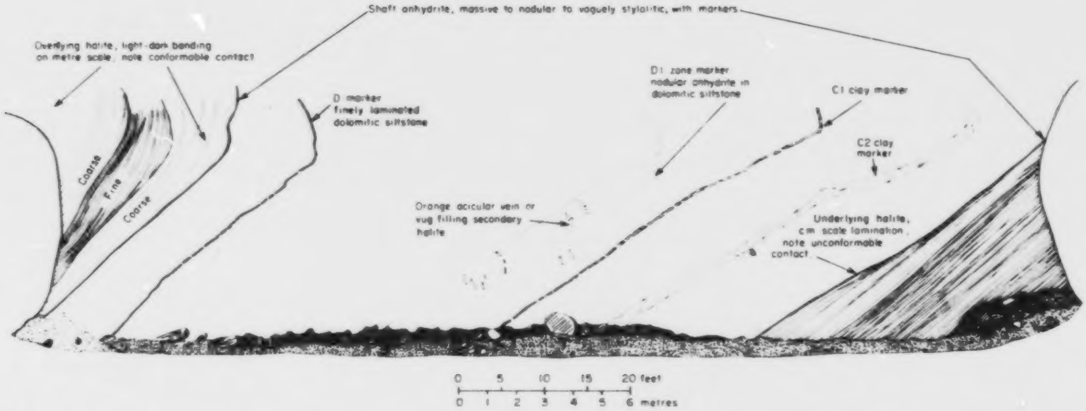
Shaft anhydrite, massive to nodular to vaguely stylolitic, with markers
Overlying halite, light-dark banding on metre scale, note conformable contact
Coarse
Fine
Coarse
D marker finely laminated dolomitic siltstone
D1 zone marker nodular anhydrite in dolomitic siltstone
C1 clay marker
C2 clay marker
Orange acicular vein or vug filling secondary halite
Underlying halite, cm scale lamination, note unconformable contact
0 5 10 15 20 feet
0 1 2 3 4 5 6 metres

Figure 1a. Stratigraphy of the shaft and borate anhydrite members, Pugwash Mine. Sketch of 830 foot level workings intersecting the shaft anhydrite member; note variable contacts and internal markers; stratigraphic top to the left.

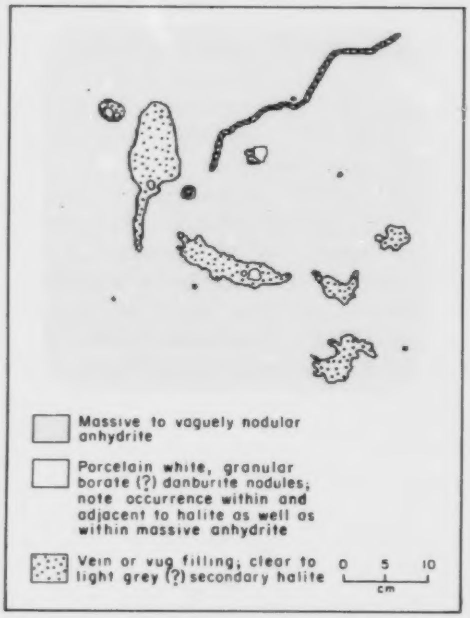
Massive to vaguely nodular anhydrite
Porcelain white, granular borate (?) danburite nodules; note occurrence within and adjacent to halite as well as within massive anhydrite
Vein or vug filling; clear to light grey (?) secondary halite
0 5 10
cm

Figure 1b. Stratigraphy of the shaft and borate anhydrite members, Pugwash Mine. Sketch of a detailed portion of the borate anhydrite member intersected on the 830 foot level; note the absence of lineation and varied occurrence of borate nodules, stratigraphic top unknown.

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MEGUMA GOLD PROJECT*

P. K. Smith

Gold exploration and research throughout Nova Scotia continues to be in the foreground of the endeavours of private, university and government institutions. Although most of the activity has been focused within auriferous Cambro-Ordovician Meguma Group turbidite metasediments, there has been notable activity in Cape Breton, where gold mineralization occurs in volcanogenic-hosted crosscutting quartz veins. Gold Brook in Victoria County was the recent site of an underground exploration program designed to evaluate the gold potential of a new zone.

As exploration throughout southern Nova Scotia is widespread, all license holders are too numerous to be mentioned. However, several deserve mention because of the noteworthy expended effort or the significant interest that such work has stimulated. These areas include Forest Hill, Cochrane Hill, Fifteen Mile Stream, West Gore and Goldenville located in the southeastern part of the Province. At Forest Hill, underground work is about to commence. Cochrane Hill has been the site of an intense geological, geochemical and diamond-drilling investigation. Current feasibility studies are underway to evaluate underground exploration. To date, Cochrane Hill has received extensive geological study by the Department. Investigations of similar magnititude will be done at several of the above-mentioned gold deposits. A plane table map has already been prepared for the open pit at Goldenville, and several diamond-drill holes logged and sampled. The Geological Survey of Canada is conducting parallel studies on a number of the other Meguma Group gold deposits.

It is anticipated these studies will catagorize the type gold deposits of southern Nova Scotia and thus aid exploration efforts.

In addition to Cochrane Hill, sections of the Wine Harbour and Issac's Harbour deposits have been intensively studied and final reports are at various states of completion. Some conclusions and observations based upon only Cochrane Hill data are as given:

1. Although the regional metamorphic grade has attained amphibolite facies throughout the region of mineralization, distinct and mappable Bouma units can be recognized. Recognition of select sequences along strike may aid in continuation of observed mineralization zones.

2. The major fold geometry of the Cochrane Hill anticline is upright isoclinal with an overturned south limb dipping 70-80° north, subparallel to the fold axial plane. Parasitic close to isoclinal folds occur on both south and north limbs of the major structure, particularly at the main ore horizon.

3. Strong shearing and subordinate fracturing occurs on both fold limbs and transects the mineralization at Cochrane Hill. Many of the graphite-rich zones closely parallel stratigraphy and have a spacial association with the gold mineralization.

4. Across the south and north limbs of the Cochrane Hill anticline, lithologies differ substantially. On the north limb, quartz-rich

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*Funded under the Canada - Nova Scotia Mineral Development Agreement compositions approaching orthoquartzite comprise portions of the stratigraphy. On the south limb, semipelite is predominant.

5. Quartz veins of the Cochrane Hill mineral deposit are subdivided into six distinct types on the basis of mineralogy, texture and crosscutting relationships. All veins truncate bedding laminations and, in places, at extremely small angles. These veins range in age from post-sedimentation to post-Acadian Orogeny.

6. Gold mineralization in quartz veins, sulphides and host rocks is spacially associated with slightly graphitic metapelite having a distinct phyllitic texture. These strata observed at Cochrane Hill are generally uncommon within the Meguma Group.

7. Gold has a strong affinity for sulphide minerals, particularly arsenopyrite and pyrrhotite. It occurs adheared to mineral surfaces, and as fracture and vug fillings. Similar relationships are observed with silicate minerals, especially garnet. Textural relationships suggest final crystallization of gold occurred late in the paragenetic scheme.

8. Lithogeochemistry shows considerable enrichment of Na_2O, TiO_2/MgO, TiO_2/Fe_2O_3 and TiO_2/P_2O_5 ratios across the ore zone particularly in the pelitic horizons. Delineation of these increases may help to widen the target area associated with gold mineralization. Further data analyses may help to reveal other element zonation associated around the auriferous zones.

9. An equilibration temperature calculated using garnet-biotite geothermometry suggests $T \approx 400-500°C$ within the ore zone. This corresponds well with pressure-temperature estimates of 3.5 kbars and 600°C observed from metamorphic mineral assemblages.

Additional information generated by this Department is anticipated to assist the better understanding of gold mineralization, and thus to stimulate the exploration and development climate throughout the Province.

ANTIMONY-GOLD POTENTIAL OF THE C-1 DIAMOND DRILL-HOLE

P. K. Smith

INTRODUCTION

A single hole diamond-drill program was conducted 1.3 km northeast of the West Gore antimony-gold property to examine the possible extension of the vein type mineralization (Fig. 1). The vertical drillhole intersected 110.1 m of Horton Group clastics and 536.4 m of thinly laminated Halifax Formation. The NTS drillhole co-ordinants are N:4994264.71 m, E:359285.88 m with an elevation of 53.3 m.

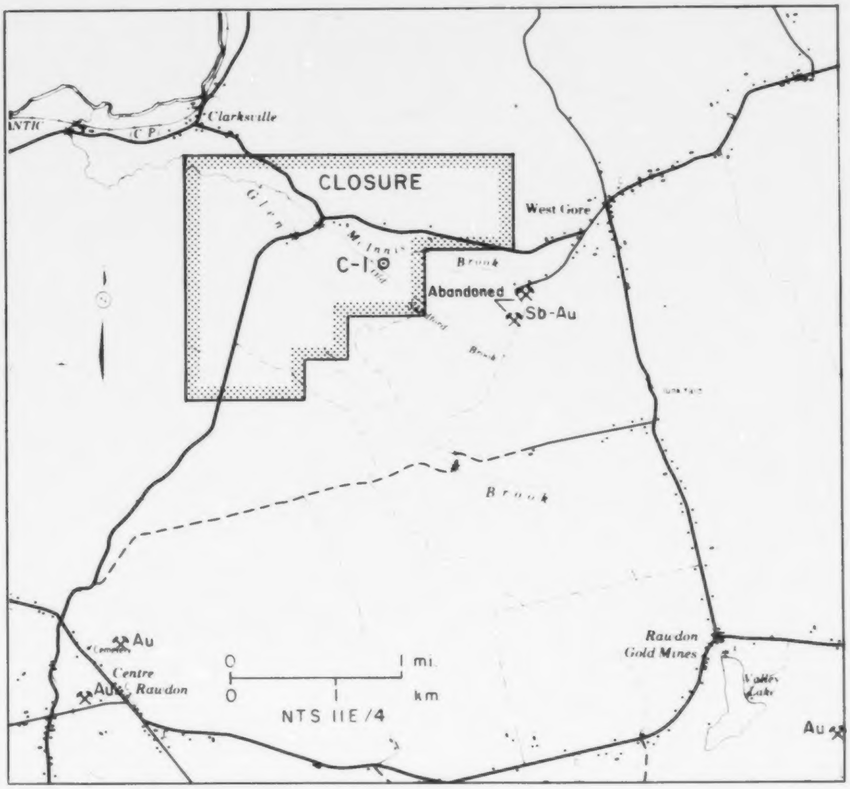

Figure 1. West Gore, Hants County.

HORTON GROUP

The intersected Horton Group strata consists of a basal coarse polymictic pebble conglomerate (5 m thick) and an upper section of mixed arkosic to clean sandstone, dark shales and mudstone as well as their sheared equivalents. Pebble constituents in the basal conglomerate include well rounded non-spherical grey to greenish grey sandstone, sericitic black

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slate, arenaceous slate and white vein quartz. Pebble constituents suggest local derivation from the underlying Meguma Group. The lithologic pebble composition of the basal conglomerate indicates an unconformable contact with the underlying Halifax Formation although considerable shearing occurs at the base.

Sandstones from the upper part of the section contain local carbonaceous debris including plant fossils. Pyrite and marcasite framboid lenses up to one centimetre in diameter occur along preferential laminae. Interbeds of fissile dark grey to black, thinly laminated shales are common. Primary structures such as crosslamination indicate the section is right way up. Carbonaceous plant material is also present in this lithology. Unlaminated mudstone with numerous concretions or nodules are present at several horizons of the Horton Group above the basal conglomerate. Minor shearing and brecciations have affected portions of these strata.

HALIFAX FORMATION

Thinly laminated horizontal strata of the Halifax Formation consist of very fine grained light to medium grey sandstone, medium to dark grey siltstone, dark grey to black shale and minor fault breccia. Quartz-carbonate veins occur throughout the entire Halifax sequence but are most prominent in the upper part of the section. Crosslamination and graded beds indicate the section is right way up throughout, with the minor exception of overturned subrecumbent folded intervals (Fig. 2). Pyrite cubes and pyrrhotite lenses occur throughout. Arsenopyrite is present, but not common, and several grains of sphalerite were observed. Subhorizontal, bedding-parallel and steeply dipping shears are common with graphite present along most of the shears. Minor cone-in-cone structures occur adjacent to two bedding-parallel shears.

VEINS

Three distinct structural vein types, having two distinct mineralogies are recognized throughout the drillhole intersection. They include crosscutting, bedding-parallel and calcite veins.

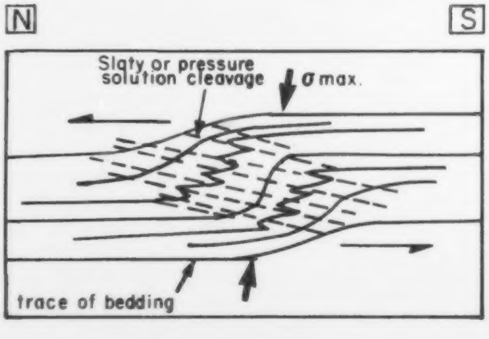

Figure 2. Local fold geometry in the Halifax Formation in the area of the C-1 diamond-drill hole.

The crosscutting veins consist mainly of quartz and ankerite with lesser amounts of chlorite, sericite, pyrite, pyrrhotite, chalcopyrite, graphite, calcite, sphalerite and wall rock inclusions. These are the most abundant vein type occurring up to six centimetres in thickness and closely resembling those observed in the dump material at the West Gore mine site.

Bedding parallel veins (Fig. 3) have similar mineralogy to crosscutting veins but are generally less than one centimetre in thickness. Wall rock inclusions are very common. Both of the above vein type have been strongly sheared.

The third vein type, although not common, consists entirely of fibrous calcite in irregular veinlets up to one centimetre in thickness (Fig. 4). Pyrrhotite is the only sulphide observed in these veins. Deformation has not seriously altered these veins.

ECONOMIC CONSIDERATION

Two factors suggest a high economic potential for strata close to this diamond-drill hole. First, there is an unusually high combined sulphide content (5-15%) for the Halifax Formation. Similar sulphide concentrations elsewhere in the Province occur commonly near ore-bearing horizons. Second, the extensive quartz veining, especially near the top of the intersected Halifax Formation, indicates high potential for vein type gold-antimony mineralization similar to the West Gore deposit.

Paleoplacer gold may be speculated for the basal Horton Group conglomerate owing to the high content of vein quartz detritus.

In conclusion, although no obvious gold-antimony mineralizaton was encountered the possibility of extending the gold-antimony ore zone towards this area seems realistic and economically exciting.

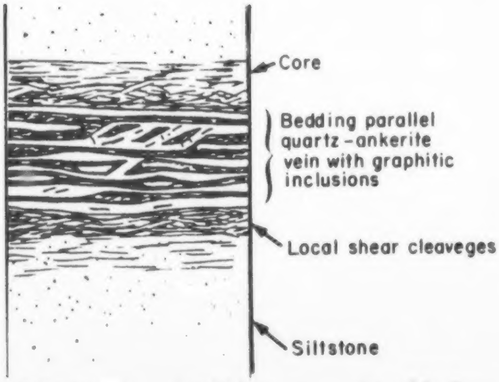
Core
Bedding parallel quartz-ankerite vein with graphitic inclusions
Local shear cleaveges
Siltstone

Figure 3. Bedding parallel quartz-ankerite vein with abundant graphitic shale inclusions.

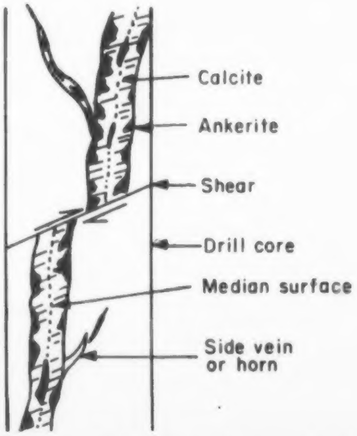

Figure 4. Crosscutting quartz-carbonate vein with small side vein. Fibrous calcite is common. Small side veins or horns are common and sometimes en echelon.

STUDIES OF MINERAL DEPOSITS ASSOCIATED WITH THE SOUTH MOUNTAIN BATHOLITH

G. A. O'Reilly

SUMMARY

South Mountain Batholith mineral deposit studies for 1985 were concentrated in two areas, the Westfield W-Sn-Ag-Au Prospect in Queens County, and the Dean and Chapter Manganese Mine northeast of New Ross, Lunenburg County.

At Westfield, granophile and precious element mineralization occurs within the endo- and exo-contact zones of a lateral protrusion of the South Mountain Batholith. Since 1980, the author has been carrying out geological mapping and geochemical studies in this area. The results are reported in O'Reilly (1985). Early in 1985, Seabright Resources Incorporated completed a program of five diamond-drill holes totalling 2215 ft. The program investigated the Jumbo Vein Zone, a thick northeast trending zone of quartz, and silicified and greisenized metasediments in the exo-contact zone of an albitized and greisenized cupola of the Batholith. Past exploration and more recent geological investigations indicate the best precious metal potential of this area lies with this and similar zones (O'Reilly, 1985). The diamond-drill program of Seabright has proven the Jumbo Zone extends along strike for 1000 ft to the west and to a depth of 430 ft.

One hundred and twenty-five sample splits from the core have been submitted for major and trace element analyses. The samples are from quartz veins, stockwork zones, and silicified and greisenized varieties of the enclosing Meguma Group slates and wackes. Examination of the geochemical nature and the origin of these zones is the prime objective of the geochemical study.

In October, the Nova Scotia Department of Mines and Energy commenced a diamond-drill program at the Dean and Chapter Manganese Mine northeast of New Ross, Lunenburg County. The program will consist of three holes intended to intersect the mineralized zone(s) at depths of 250,500 and 1,200 ft.

These granodiorite hosted manganese deposits are the only past producing mines within the confines of the Batholith and were worked only to depths of just below 200 ft. Previous workers have often speculated that these vein deposits may grade at deeper levels, into deposits of polymetallic sulphides or granophile elements, or both, (Hewett, 1964; Bishop and Wright, 1974; Graves, 1982). The diamond-drill program will test this hypothesis as well as provide complete sections of the mineralized zone(s) and associated alteration haloes for detailed petrological, geochemical and mineralogical studies. At writing, the first hole is completed and has successfully intersected and cored the deposit at a depth of 260 ft. The remaining holes should be completed by the end of 1985.

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*Funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement

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SOUTH MOUNTAIN BATHOLITH PROJECT - BEDROCK MAPPING*

M. MacDonald, M. Corey, L. Ham and R. Horne

INTRODUCTION

The area of the South Mountain Batholith (SMB) mapped during the 1985 field season includes NTS sheets 11D/05, 11D/12, 11D/13 and the eastern half of 21A/16 from Highway 14. These areas have been previously mapped by Faribault (1908a; 1908b; 1908c; 1916; 1931), Cormier and Smith (1973), Smith (1974), Dwyer (1976) and Ferguson (1985). Only Cormier and Smith (1973), Smith (1974) and Dwyer (1976) attempted to subdivide the granitic rocks. The resulting granodiorite/monzogranite/alaskite (leucogranite) subdivisions along with all the aforementioned authors granite/country rock contacts are presented in the compilation map for Nova Scotia (Keppie, 1979).

As a result of the current mapping, several varieties of granodiorite, biotite monzogranite, biotite-cordierite monzogranite, and two-mica monzogranites (including polyphase intrusive complexes and small porphyry bodies) have been outlined. In addition, several areas previously mapped as granodiorite have now been recognized as monzogranite. Several new mineral occurrences have been discovered on each of the map sheets.

DESCRIPTION OF ROCK TYPES

Granodiorite

Biotite granodiorite (DCgd)

Present on 11D/13 and 21A/16; medium grey to bluish grey; medium- to coarse-grained; megacrystic; biotite-rich.

Textural variations include:

1. A marginal phase (DCgda and DCgdb) present on all sheets except 11D/05; fine, medium and medium- to coarse-grained; equigranular; slightly megacrystic.

2. A very biotite-rich unit (DCgdc) present exclusively on 21A/16; medium to dark brownish grey; predominantly medium grained; equigranular.

Monzogranite

Within the monzogranite classification three broad classifications may be implemented. These include biotite, biotite-cordierite and two-mica monzogranites.

Biotite Monzogranite

Light to medium grey; medium- to coarse-grained; megacrystic with trace muscovite and possibly cordierite.

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Included in this group are:

1. Sandy Lake Monzogranite (DCmgSL), present on 11D/12, 11D/13 and 21A/16; a medium grained equigranular variation (DCmgSLa) is present on 11D/13.

2. Harrietsfield Monzogranite (DCmgHF) present on 11D/05 and 11D/12; varities are cordierite-rich (DCmgHFa), megacryst-poor (DCmgHFb) and fine- to medium-grained and often porphyritic (DCmgHFc).

3. Prospect Monzogranite (DCmgP) present primarily on 11D/05, but also on 11D/12.

Biotite Cordierite Monzogranite

Light whitish grey, medium grey, pinkish to orangish grey; medium- to coarse-grained; biotite poor with highly variable muscovite, cordierite and K-feldspar megacryst content.

This division is comprised entirely of the Halifax Monzogranite (DCmgHX) and is present on both 11D/12, 21A/16 and 21D/05. On 11D/12 a medium-grained often porphyritic, slightly megacrystic unit (DCmgHXa) is present.

Two-Mica Monzogranite

This grouping displays the widest range of colour, texture, grain size and modal mineralogy of all the rock units in the four map sheets. In general, rocks of this classification are finer grained, more muscovite-rich and have a sharp intrusive contact with the above-mentioned units.

General descriptive notes are:

Light to medium grey, bluish grey, buff, orange, pink, red; fine- to medium-grained and may contain coarse-grained material; equigranular, porphyritic to hypidiomorphic-granular; minor minerals include biotite, muscovite, cordierite, garnet, tourmaline and minor sulphides.

Included in this group are:

1. Big Indian Lake Polyphase Intrusion (DCmgBI) exposed on both 11D/13 and 21A/16.

2. Tantallon Complex exposed primarily on 11D/12 (may extend westward to 21A/09) and comprised of (DCmgTCa) typified by variable colour, texture and composition, (DCmgTCb) by medium bluish grey porphyry with cordierite phenocrysts and (DCmgTCc) as medium grained and equigranular.

3. South Lake Monzogranite (DCmgSO) exposed primarily on 21A/16 but also on 11D/13, with a medium grained equigranular variation present (DCmgSOa) on 21A/16.

4. Card Lake Complex (DCmgCL) present on 21A/16 (and extending southward to 21A/09).

>. Walsh Cove Leucogranite (DCmgWC) as small plugs on 11D/13.

In addition to the above-mentioned units, there are numerous discrete intrusive porphyry bodies generally > 2 km^2 which may be divided into two broad categories:

1. Porphyries (DCmgp) are present on all map sheets.

2. Mafic Porphyries (DCmgmp) are present on 11D/05 and 21A/16.

MINERAL OCCURRENCES

Numerous new mineral occurrences were discovered during the course of bedrock mapping. The most significant of these are briefly described below:

1. In 11D/13, polymetallic mineralization (W-Cu±Mo) was found in quartz veins (Christie Lake showing).

2. Wolframite- and scheelite-bearing quartz veins also occur on 21A/16 (Powerline showing).

   Both of the above mineral showings occur within a microgranite phase of the Big Indian Lake Polyphase Intrusion (DCmgBI). A third showing occurs in aplite within the garnetiferous monzogranite of DCmgBI.

3. On 11D/12, at the head of Shad Bay, wolframite and chalcopyrite were found in a slightly greisenized porphyritic phase of the Tantallon Complex (DCmgTC).

4. At Sandwich Point (11D/12) near the mouth of Halifax Harbour, coarse disseminations of arsenopyrite and pyrite occur in sheeted quartz-muscovite greisen veins within the Halifax monzogranite (DCmgHX). Preliminary analysis (AA) returned 525 ppb Au in an arsenopyrice-rich (6.890 by colourimetry) quartz vein. Initial discovery of this occurrence was made by T. E. Smith.

5. Near Third Pond north of Sambro (11D/12), two narrow wolframite-bearing quartz veins were discovered in the biotite monzogranite (DCmgHF). This ccincides with an anomalous 10.9 ppm tungsten in a sediment sample from Third Pond (Rogers et al., 1985).

In addition to the above showings, many previously documented occurrences occur throughout the project area. These consist primarily of small isolated polymetallic U, Cu, Pb, Zn, Ag and Be showings. The most significant uranium discovery was by Maritime Exploration Syndicate (M.E.X.) in a gravel pit approximately 500 m north of the Christie Lake tungsten showing. Visible torbenite, autunite and minor chalcopyrite occur in an extensively hematized, northeast trending shear zone.

Intense and pervasive hydrothermal-pneumatolytic alteration is generally associated with but not restricted to the above mineral showings, and may include hematization, albitization, silicification, desilicification, greisenization, biotitization and tourmalinization. In contrast to these localized alteration features, widespread deuteric effects such as chloritization, saussuritization, sericitization and kaolinization occur in varying degrees within all rock types throughout the entire field area.

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SOUTH MOUNTAIN BATHOLITH PROJECT-PLEISTOCENE SURVEY*

P. Finck and M. Graves

INTRODUCTION

Mapping and sampling of the surficial geology overlying the granitic terrane of central and southwestern Nova Scotia commenced during the 1985 field season. The study areas were within NTS map sheets 11D/05, 11D/12, 11D/13 and 21A/09, east of Highway 14.

Erosional and depositional features of ice movement were mapped by field investigations and air photograph interpretation. Erosional features include areas of thin till (<1.0 metre) and glacial striations. Detailed mapping of different glacial striae sets will aid in the interpretation of ice movements and directions of till transport. Mapping depositional features involves studying landforms and local till stratigraphy. Tills were examined on the basis of lithology, texture, fabric and sedimentary structures. These criteria will assist in determining the origin of the tills and their relationship to bedrock.

As part of the program, 420 "C" horizon till samples were collected at two kilometre centres. Approximately 8-9 kg of till matrix (<12.0 mm) was collected for geochemical studies. Clasts (>12 mm diameter) screened from the till were retained and later subdivided according to rock type. Histogram maps (see poster display) were produced for each of the NTS map sheets 11D/05, 11D/12, 11D/13 and 21A/09. Each histogram represents the relative percentages of rock types found in the pebble fraction at each sample site.

SIMPLIFIED CLAST DATA

Figure 1 is a generalized lithological map, based on groupings of pebble data by rock type, of the surface till sheet for map sheets 11D/05 and 11D/12. The three units defined are biotite monzogranite, biotite-cordierite monzogranite, and two-mica monzogranite and porphyries. Identification and division of the granite types were made by noting: (1) modal percentages of biotite, muscovite and cordierite, (2) grain size, (3) texture, (4) K-feldspar to plagioclase ratio (determined by sodium cobaltinitrite staining), (5) colour and (6) alteration. In addition, discussions with those doing bedrock mapping, of mineralogical and textural variation observed on the outcrop scale, aided in the division of the clast geology.

There is a major granite division in the till from north to south through the centre of the Halifax Peninsula at Nine Mile River. East of Nine Mile River, the granite till is dominated by biotite monzogranite. Smaller areas of biotite-cordierite monzogranite, leucoporphyry and two-mica monzogranite occur at Fergusons Cove and Ketch Harbour. West of Nine Mile River, the clast geology changes rapidly to biotite-cordierite monzogranite and two-mica monzogranite. The area of biotite-cordierite monzogranite clasts in the till extends north to Upper Tantallon. Two-mica

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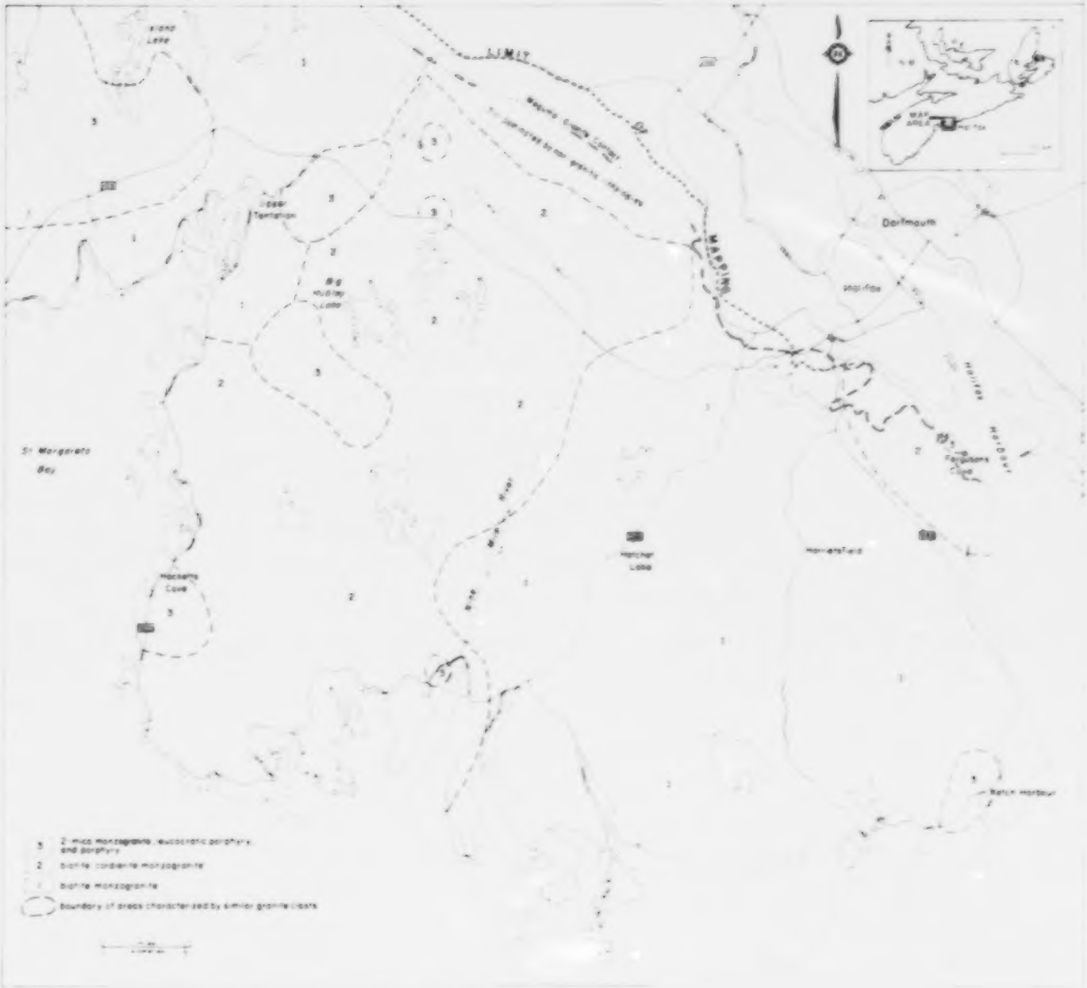

Figure 1. Generalized map showing the dominant granitic lithology from the pebble fraction of the surface till sheet.

monzogranite clasts are found near Hacketts Cove in a broad belt extending northwest from Hubley Lake to Ingram River. Biotite monzogranite clasts were also seen north of St. Margarets Bay.

Figure 1 shows only areas dominated by a single granitic rocktype and disregards the occurrence of non-granitic clasts. At Hammonds Plains, Goodwood, Harrietsfield, Chebucto Head and Hacketts Cove, pebbles in the till are dominated by Meguma Group metasediments and other 'foreign' lithologies (Fig. 2). These areas correlate with a dark brown, mud-rich till having a non-granitic clast content ranging from 60-100 per cent of the pebble fraction. Stratigraphically, these areas may represent 'windows' of older till in the regional surface granite dominated till.

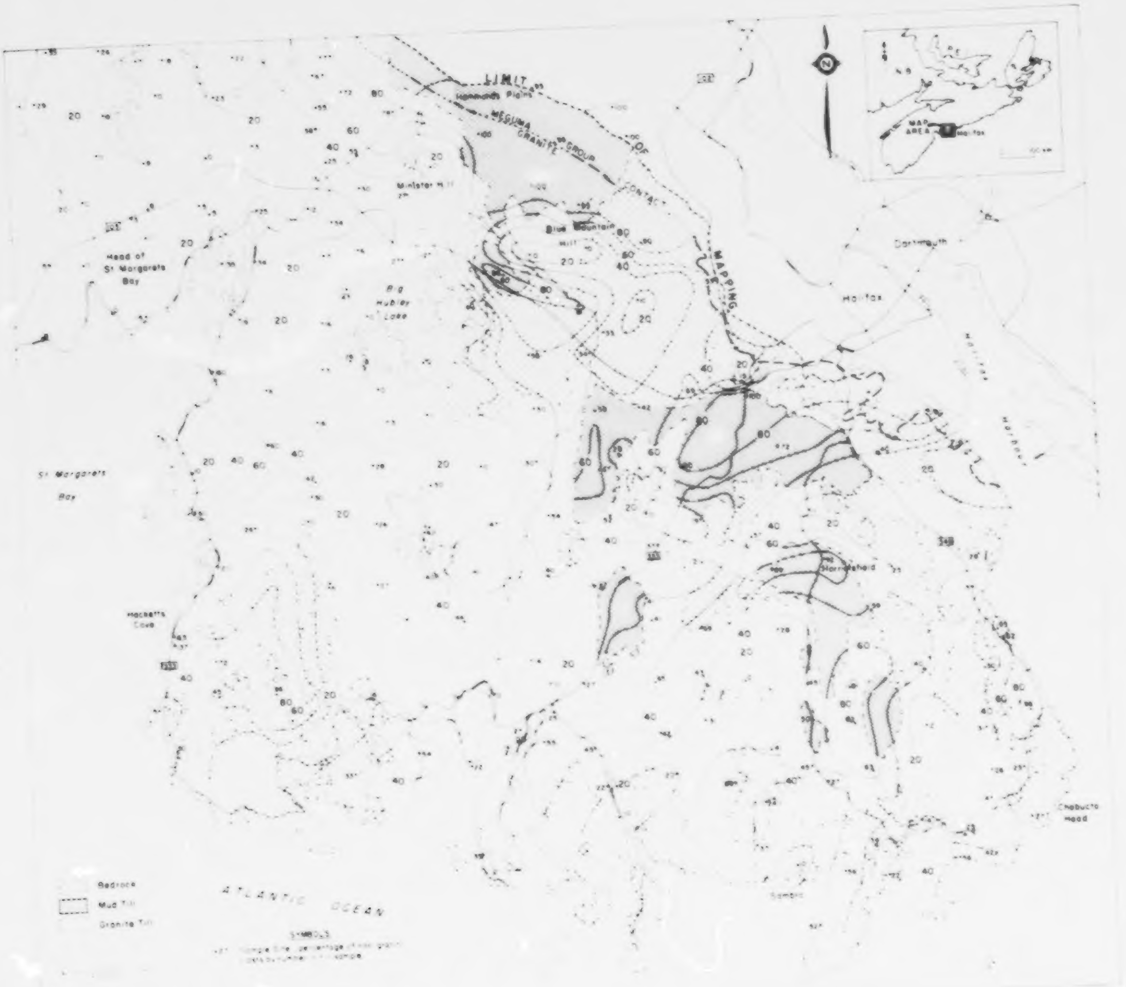

Figure 2. Halifax Peninsula: Contour map of the non-granitic clasts in the surface till sheet. Clasts counted were larger than 1.25 cm.

Contours of non-granitic clast concentration (Fig. 2) show a gradation between the mud-rich till and the granite dominated till. This gradation may represent reworking of non-granitic clasts from the mud-rich till into the granite till. An older dark coloured granite till which contains elevated concentrations of non-granitic lithologies (up to 25 per cent) is frequently found in drumlin cuts stratigraphically below the mud-rich till and the loose sandy granitic till. The regional non-granitic clast background may in part represent reworking of the dark coloured granite till. When tills are used as an aid in bedrock mapping recognition of the mud-rich as far-travelled is crucial. Therefore, when correlating till with local bedrock, foreign clasts should be ignored and the presumably more local granitic clasts examined.

Pb/Zn PROJECT*

James M. Patterson

The economic and fiscal attractiveness of Nova Scotia as a place to find a mine has been well documented in a recent study prepared for the Department of Mines and Energy by the Centre for Resource Studies (Davis, MacKenzie and Bilodeau,1985).

The Pb/Zn (±Ba±F) Project will reinforce this attractiveness by selecting type-deposits from different geological terranes. Each type-deposit will be investigated, all information sources accessed, the acquired information synthesized and compiled, ore mineralogy and petrology of the enclosing rocks described, comparisons made with similar national and international deposits, genetic models developed, and most importantly, exploration guides developed to allow industry to follow up the prospects identified.

Five deposit types have been selected for study. They range in age from Precambrian to Upper Carboniferous.

(1) Precambrian - metacalcareous rocks (George River Group)
  - Lime Hill (Zn)
    Meat Cove (Zn)

(2) Precambrian - exhalative/sedimentary (Bourinot Group)
  - Stirling/Mindamar Mine (Cu-Pb-Zn±Au+Ag)

(3) Cambro-Ordovician - Meguma Group
  - Eastville (Pb-Zn)

(4) Lower Carboniferous - Horton/Windsor contact
  - Walton (Zn-Pb-Ag-Ba)
    Smithfield (Zn-Pb)
  - carbonates
    - Gays River (Zn-Pb)
      Jubilee (Zn-Pb)

(5) Upper Carboniferous - sandstone hosted
  - Yava (Pb±Zn?)
    Canfield Creek

Where appropriate, the relationships between the deposits, and basin evolution and development will be assessed.

The project is spearheaded on three fronts. The Geological Survey of Canada is leading the investigation at the Lime Hill, Yava and Canfield Creek deposits, while Dalhousie is researching the Gays River and Eastville deposits. The Nova Scotia Department of Mines and Energy will concentrate initially on the Walton and Stirling(Mindamar) deposits.

Walton, because of its production history and the vast amount of data available, may be considered a prime starting point in the

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*Funded by Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement

Department's efforts to better understanding the deposits along the important Horton/Windsor contact. An understanding of the volcanogenic massive sulphide deposit at Stirling, with its associated precious metal values, is considered the key to exploration for similar type deposits in the volcanic-sedimentary environment.

Renewed activity at Gays River makes the Dalhousie research timely. The studies at Eastville will contribute to our understanding of base metals in the Meguma Group, a potentially new terrane for base metals (± precious metals) exploration.

Investigations lead by the Geological Survey of Canada, of the zinc deposits at Lime Hill and possibly Meat Cove, will provide a better understanding of these deposits and hopefully lead to the generation of fresh ideas and approaches. Analogies with certain European deposits suggest Yava may have potential zinc ore bodies. Study of the Canfield Creek deposit will assist in the understanding of the genesis and controls of base metal mineralization in the Cumberland Basin.

The slow recuperation of the mining industry from the recession and the continuing depressed state of metal markets means small tonnage (2-3 million tons) high grade polymetallic deposits are more attractive. The aim of this project is to stimulate new exploration activity from a much stronger base thus leading to new mineral discoveries and mine development.

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GEOCHEMICAL SURVEYS*

P. J. Rogers and R. Mills

INTRODUCTION

Various aspects of geochemical exploration and its application within Nova Scotia continued, with funding, as part of the Canada-Nova Scotia Mineral Development Agreement (1984-1989). R. Mills was recruited in May 1985 as assistant geochemist to work on the Geochemical Atlas Project.

Geochemical Atlas Database

All commercial exploration geochemistry assessment files were reviewed, compiled and entered into a computer file with details of sampling, elements, company, area and analytical method. Data from previous surveys were checked, all sample locations were digitized and coverage maps at the 1:250 000 scale were produced for stream and lake sediments, stream and lake waters.

Open File Maps at the 1:50 000 scale for data of stream, lake sediments, and stream and lake waters from 1982 and 1983 surveys were checked and prepared for Open File release (Fig. 1).

Rushmere Lake Follow-up Study

A 1984 study of assessment information filed by several companies on East Kemptville yielded, after computer processing, interesting anomalous dispersion patterns in the vicinity of Moosefly and Rushmere Lakes, Yarmouth County. A bulk lake sample taken from Moosefly Lake contained 32 ppm tin as discrete grains of cassiterite (Rogers and Garrett, in press).

In 1985 a follow-up survey of the tills and streams was conducted to investigate the nature of the anomaly. A detailed investigation of drill core from the area is reported by Smith (1984). Unaltered basal till samples were taken from 31 pits, with an average pit depth of one metre, on a 800 m square grid. The till in the area is a compacted, coarse sandy till with altered feldspars (sericite).

Stream sediment samples from 12 sites were wet-sieved in the field. All samples have been submitted for sample preparation and await analysis for elements including Sn, W, Au, Bi, Sb, Cu, Pb, Zn and Ag.

Reanalysis of Meguma Lake Sediments

A total of approximately 3400 centre lake bottom samples were analysed for Cu-Pb-Zn-Ag-Li-F-Nb-Rb-Sn-Zr-Ti-Th-Sb-As-W-Au (Rogers et al., 1985).

After quality control procedures, the data were plotted at the 1:500 000 scale using an Applicon colour plotter. Large-scale geochemical patterns in the Meguma Zone are revealed by single element plots. The

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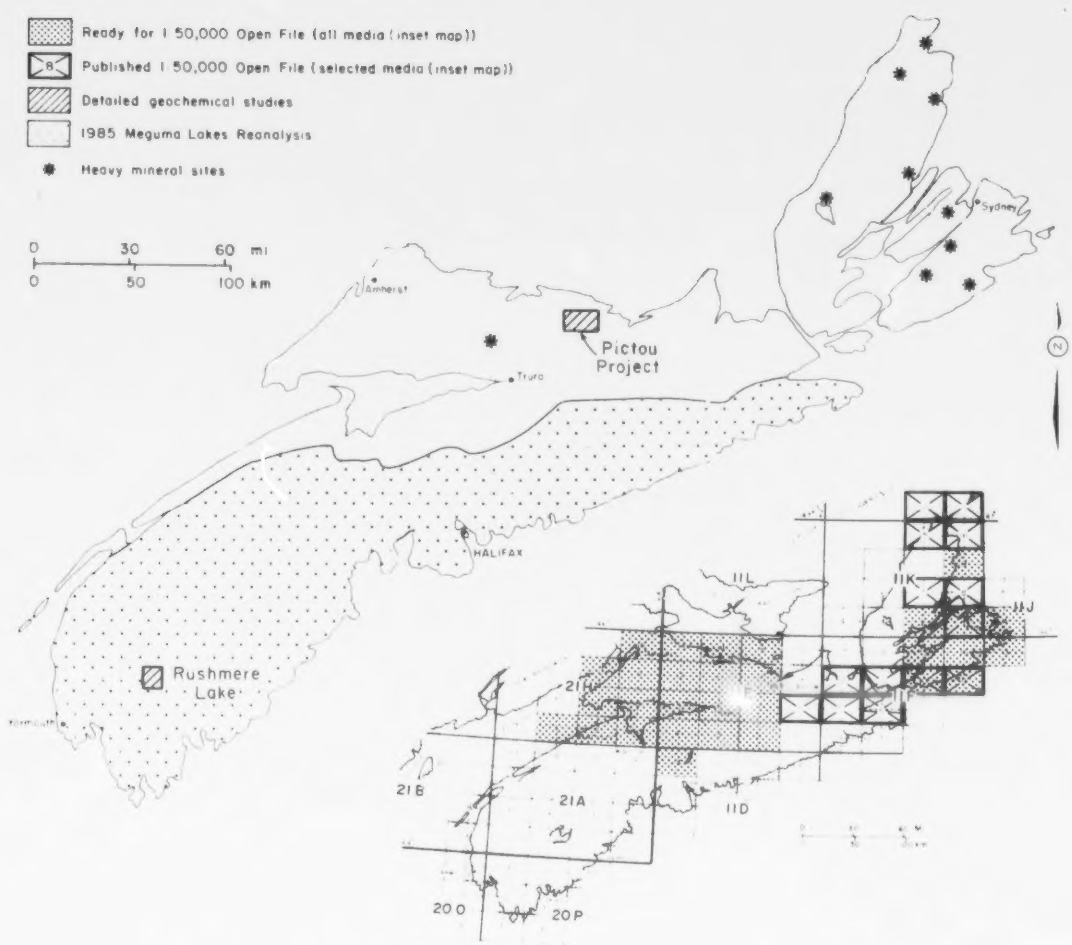
*Funded by Geological Survey of Canada and Nova Scotia Department of Mines and Energy under the Canada - Nova Scotia Mineral Development Agreement


Ready for 1:50,000 Open File (all media (inset map))
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8
Detailed geochemical studies
1985 Meguma Lakes Reanalysis
Heavy mineral sites
0 30 60 mi
0 50 100 km
Amherst
Truro
Pictou Project
Sydney
HALIFAX
Rushmere Lake
Yarmouth
N
11L
11K
11J
21H
21B
21A
11D
20O
20P

Figure 1. Geochemical surveys: main activity areas.

East Kemptville area has significant Sn highs, and there is a strong relationship between the anomalous Sn areas and the South Mountain Batholith (SMB). The W plot shows similar concentrations around East Kemptville and the New Ross-Millet Brook area but differs in having major concentrations in the exo-contact zones of the SMB. Anomalous patterns of W and Au are also related to exo- and endo-contact zones especially in the Musquodoboit Batholith.

The dataset was computer processed and for each sample a 'rating' was produced for all 16 elements. Each anomalous sample is thus given a rating depending on the strength and magnitude of the elemental value, as follows:

> 99th	percentile	rating = 4
> 98th < 99th	percentile	rating = 3
> 95th < 98th	percentile	rating = 2
> 90th < 95th	percentile	rating = 1
> 90th	percentile	rating = 0

The multiple rating scores for each element are summed and a total rating produced. In this way it is possible to plot a multi-element map for the Meguma Zone showing the location of anomalies of the different elements.

Preliminary analysis of these results indicates a number of important elemental associations witin the dataset. These include:

Cu-Pb-Zn±Ag; F-Li-Nb-Rb±Sn, Ag, W; Zr-Ti-Th; Sb-As-W-Au

Geochemical Mapping and Heavy Mineral Surveys

Orientation surveys were conducted on a number of selected mineral showings as a prelude to a full-scale survey (Fig. 1). Heavy minerals in stream sediment systems occur as discrete, resistate mineral grains produced by mechanical weathering. They are thus extremely useful to give direct indications of metallogenic associations normally only investigated indirectly using anomaly patterns based on chemical weathering and hydromorphic dispersions. Mineralization bearing gold, cassiterite, wolframite, scheelite, molybdenite and chromite are best investigated directly rather than relying on secondary dispersion patterns (Levinson, 1980).

In order to correctly indentify various metallogenic associations at the regional scale, any geochemical mapping must provide province-wide coverage of a quantitative, repeatable sampling technique. Unfortunately effective panning of stream sediments is an acquired skill and therefore operator dependent. Investigation of mineral yields from panning versus a bulk sample (Rogers and MacDonald, 1984) indicates much more reliable results from the heavy liquid separation of a bulk sample.

The sampling alternatives available for a regional survey must also address the central issue of particle capture of sufficient material (about 10 gms minimum) for reproducible analysis. A conflict arises between the sample size needed and sample collection time, and thus cost of the survey. During this summer, field testing of a multiple sieve set was conducted at selected sites within the Province (Fig. 1). After experimentation a field method involving the collection of three fractions is proposed:

(a)	- 1 mm + 500 μ	coarse material
(b)	- 500 μ + 64 μ	heavy minerals
(c)	- 64 μ	fines

The fraction (a) would not normally be submitted for analysis but retained for anomaly checking at a later stage. Fraction (b) would be the main analytical fraction for resistate mineral anomalies while (c) would provide a check for the more traditional hydromorphic anomalies.

Pictou County Follow-up Project

Due to the accidental death of the principal investigator, Ian J. MacEachern, all of the 1984 samples of tills, streams and soils have been submitted for analysis, principally for Cu-Pb-Zn-Ag-Fe-Mn.

As part of a well water orientation survey, well water samples from the area will be collected to establish groundwater geochemical patterns and its effect on hydromorphic dispersion on the soils from the project area.

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SURFICIAL MAPPING RESULTS: PICTOU, GUYSBOROUGH AND ANTIGONISH COUNTIES, NOVA SCOTIA*

R. A. Myers and R. R. Stea

INTRODUCTION

This surficial mapping program, carried out under the Canada-Nova Scotia Mineral Development Agreement, is a continuation of a regional mapping and till geochemistry program in northern Nova Scotia initiated in 1981 (Stea and Finck, 1984). The 1985 map area encompasses the Antigonish Highlands and surrounding lowlands in western Pictou, northern Guysborough County and eastern Antigonish County. This report summarizes field observations with emphasis on the definition of ice flow patterns.

PHYSIOGRAPHY AND GENERAL GEOLOGY

The Antigonish Highlands form the major physiographic region in the study area. The Highlands are bounded to the north by the Hollow Fault and to the south by the Cobequid-Chedabucto Fault. To the east lies the Devono-Carboniferous Antigonish Basin (Fig. 2). The Highland rocks consist of Hadrynian metavolcanics and metasediments. Lower Paleozoic strata outcrop along the flanks of the Highlands and along local fault basins (Murphy, 1984). Cambrian to Devono-Carboniferous intrusions, including syenites, granites, diorites and gabbros are common in the southern part of the Highlands and along Cape George. The surrounding lowlands are largely underlain by Devono-Carboniferous sediments with lesser amounts of lower Paleozoic sediments and volcanics present north of the Hollow Fault. The Southern Uplands, in the southern part of the map area, are underlain by Cambro-Ordovician slates and greywackes of the Meguma Group and Devono-Carboniferous granitic intrusions.

EROSIONAL EVIDENCE FOR ICE MOVEMENTS

The direction of movement of ice flow over individual outcrops can be determined by the observation of: (1) mini-crag and tail features; (2) stoss and lee form of outcrop and (3) nail-head striae and crescentic gouges. One hundred and ten striae measurements were taken in the map area during the 1984 and 1985 field season. Seventy-five per cent fall within three broad azimuth groupings (Fig. 1). The relative ages of these striae were determined from key outcrops in which two or more crosscutting sets of striae are present.

Oldest Southeast Trends

Striae within the 120° - 170° grouping are the oldest and probably result from two separate early ice movements to the southeast across the Highlands (Fig. 2a). Evidence for these early flows comes

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*Funded by Nova Scotia Department of Mines and Energy and Geological Survey of Canada under the Canada - Nova Scotia Mineral Development Agreement

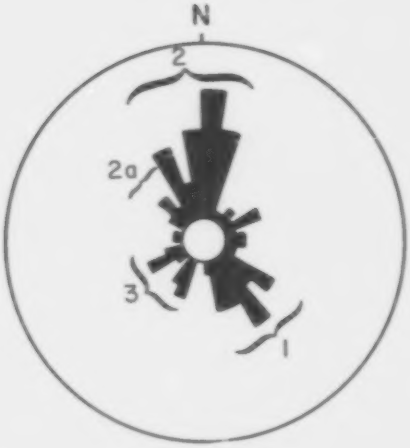

Figure 1. Total striae used to determine sense of direction of ice flow.

from three outcrops in the southern Highlands where striae trending 160°-170° post-date 135°-140° trending striae. A pyroclastic outcrop just east of Eden Lake has a scoured and polished bedrock surface. On this surface a deep groove, with crag and tail forms trending 138°, is truncated by a surface inscribed with striae trending 155°-160°. These striae are correlated with ice flow patterns 1 and 2 of Stea and Finck (1984). Eastward trending striae at Cape George (Fig. 2), which are cut by northeastward trending striae, are also believed to relate to this early phase.

Intermediate Northward Trends

Striae within the 330°-020° grouping (Fig. 1) may be divided into two regional patterns (Figs. 1 and 2). West of Eden Lake, striae trending northward to northwestward postdate southeastward trending striae. East of Eden Lake, striae trending north-northeast across the Highlands may have been formed by divergence of a major northward ice flow stemming from the Southern Uplands (Stea and Finck, 1984; ice flow pattern "3") or by a separate ice flow centred over the southern Antigonish Highlands. Striae in group 2a (Fig. 1) provide evidence of northwestward ice movement on the southwest flank of Browns Mountain (Fig. 2). These are correlated with the broad northward ice flow pattern in northern Nova Scotia, although no relative age determinations are available. Similarily, northeastward trending striae (dotted arrows in Fig. 2b), which cut southeastward trending striae at Cape George, are believed to be associated with the regional northward ice flow called flow pattern "3" by Stea and Finck, 1984.

Youngest Southwest Trends

The youngest striae trend west-southwestward in the eastern map area, but swing to a southward direction in the central map area (Fig. 2c). Striae with these trends were not observed in the Antigonish Highlands. The centre of this ice flow may have been in the southern Antigonish Highlands. Radial flow from this ice cap in the southern Antigonish Highlands could also account for northwestward trending striae on the Highlands and some southeastward trending striae (dashed arrows; Fig. 2c).

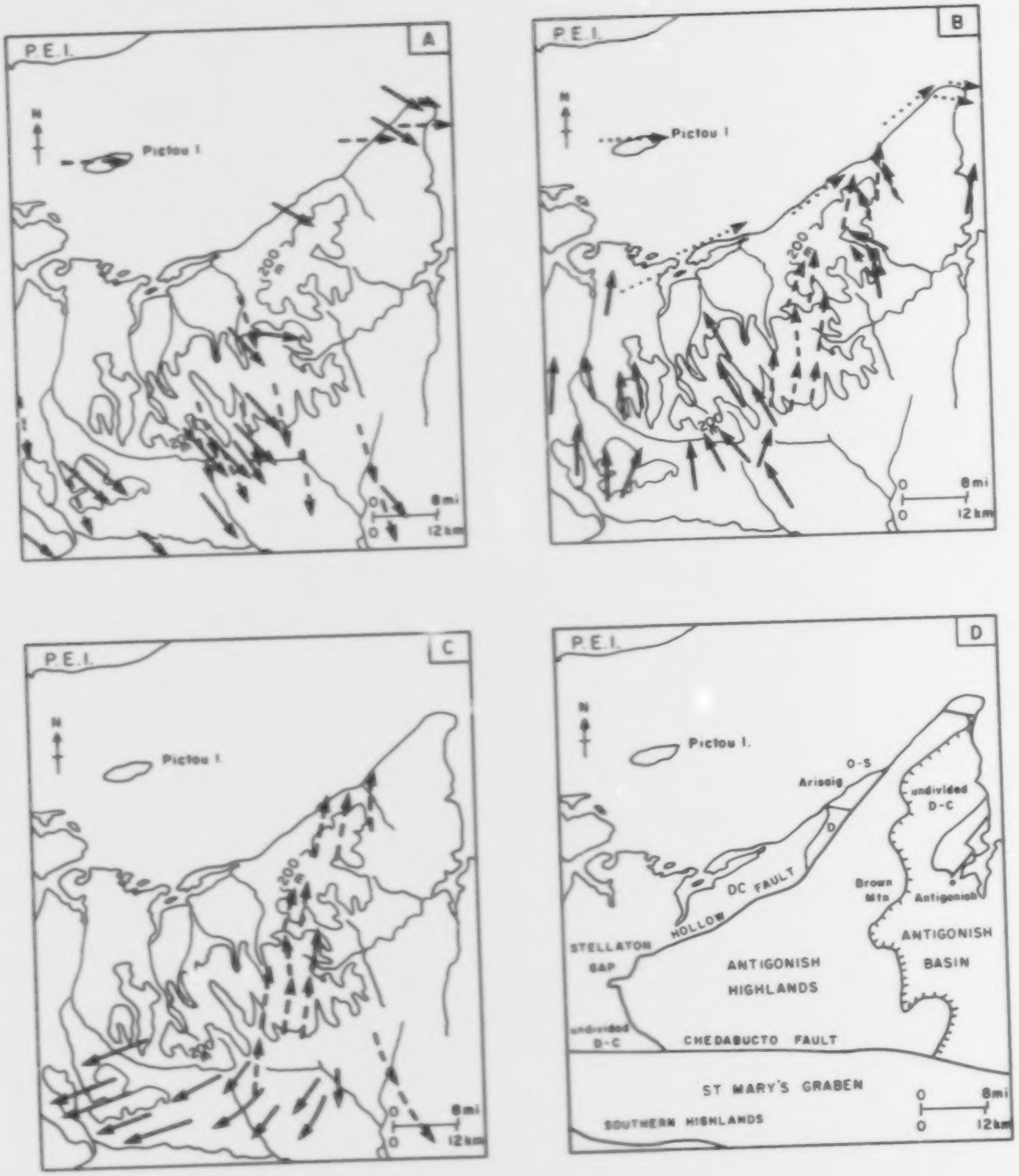

Figure 2. Inferred ice movements as determined from mine crag and tail or stoss/lee relationships, or both. Relative ages for flows shown with solid arrows were determined by crosscutting striae on key outcrops. Dashed or dotted arrows shown in more than one frame have an uncertain age and may be related to one or more flow events. (see text for details).

SURFACE TILL PROVENANCE AND RELATIONSHIP TO REGIONAL ICE FLOWS

An examination of the relationship between till units and the ice flows which emplaced them awaits the results of pebble counts on some 300 till samples. At present, general observations can be made as follows.

(1) A reddish brown, compact, stony, silty-sand till is found occasionally in the Antigonish Highlands. It rests on bedrock inscribed with striae trending northward. Till fabric measurements indicate this till was formed by northward flowing ice. A very compact,reddish, matrix-rich till overlies bedrock inscribed by southeastward striae trending. In some cases these tills are indistinguishable.

(2) The surface till sheet in the Highlands is a loose, grey stony till comprised primarily of local material. It overlies the reddish-brown till at several localities.

(3) In the areas south of the Highlands, distinctive Antigonish Highland erratics found in the surface ablation boulder mantle suggest transport of at least 15 to 20 km by southeast flowing ice.

(4) North of the Hollow Fault (Fig. 2) the paucity of Highland erractics in the surface ablation boulder mantle may indicate either a lack of erosion by northward flowing ice or a subsequent movement from a direction other than the Highlands. Antigonish Highland erratics are abundant in glacio-fluvial deposits north of the Hollow Fault.

CAPE GEORGE COASTAL SECTIONS

Twenty-four coastal sections were measured from Arisaig on the Northumberland Strait to MacIssac's Point (Fig. 2). Eleven representative sections are presented in Figure 3. In most of these sections is a common sequence of stratified drift comprised of sands and a bouldery to gravelly sandy diamict resting on a wave cut bench, believed to be of Sangamonian age (Grant, 1980). Three till units were noted above the bouldery diamict. Two of the till units, overlying the stratified sequence, contain shell fragments of Mercenaria (sp) which have been dated at >37 000 yrs. B.P. (GSC-4018, D. R. Grant, personal communication). These shells were probably entrained in the till as ice moved south and to southeast, and across the Northumberland Strait. A correlation between the tills at Cape George, and their direction and mode of emplacement awaits analysis of till fabrics, local striae data and the results of detailed sampling at four type sections.

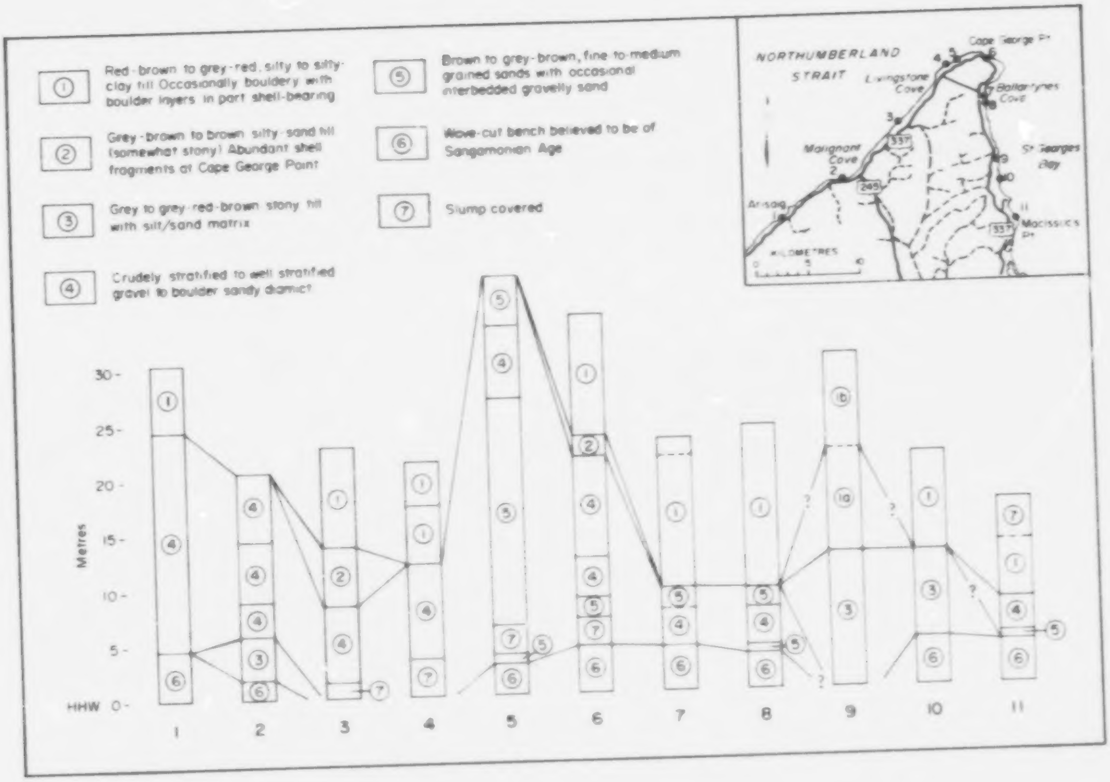
① Red-brown to grey-red, silty to silty-clay till Occasionally bouldery with boulder layers in part shell-bearing
② Grey-brown to brown silty-sand till (somewhat stony) Abundant shell fragments at Cape George Point
③ Grey to grey-red-brown stony till with silt/sand matrix
④ Crudely stratified to well stratified gravel to boulder sandy diamict
⑤ Brown to grey-brown, fine to medium grained sands with occasional interbedded gravelly sand
⑥ Wave-cut bench believed to be of Sangamonian Age
⑦ Slump covered
NORTHUMBERLAND STRAIT
Cape George Pt
Livingstone Cove
Ballantynes Cove
Malignant Cove
St Georges Bay
Arisaig
Macissics Pt
337
245
KILOMETRES
0
5
10
Metres
30
25
20
15
10
5
HHW 0
1
2
3
4
5
6
7
8
9
10
11
1a
1b
?

Figure 3. Sections exposed along the coast in the Cape George area. Datum is the high tide.

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EDUCATION AND PUBLIC AWARENESS*

H. V. Donohoe, Jr. and M. E. Devanney

The two geologists of the Education and Public Awareness Program (EPAP) in the Mines and Minerals Branch are involved in developing a number of informative programs describing the geology and mineral resources of the Province. In addition, the mandate of the Canada - Nova Scotia Mineral Development Agreement (CNSMDA), and its various programs and projects is an important part of the operation of the Program. The objectives of the EPAP and Public Information Program of the CNSMDA are to prepare publications, audio-visual presentations and displays that will describe the geology, mineral resources and mining industry of the Province. The CNSMDA programs, their importance and results will also be highlighted. Pamphlets, talks, walks, displays and photographic packages are only some of the endeavors receiving CNSMDA support.

A number of brochures and pamphlets on such topics as the geology of the Halifax - Dartmouth area, and economic rocks and minerals of the Province are at the preparation stage. Several longer publications in draft form include *Gold in Nova Scotia,* and a revised edition of *Geology, Minerals and Mining in Nova Scotia*.

During the summer, many groups have been guided on a walking tour of the building stones in downtown Halifax. This project has been funded by the CNSMDA, and is one of several co-operative projects initiated by the Department and the Nova Scotia Museum. The walk highlights the different types of rocks and minerals used in the building stones as well as the historical development of the building stone industry in the Province. The booklet *A Walking Tour of Rocks, Minerals and Building Stones in Downtown Halifax* describes buildings of interest and includes photos, illustrations and map which will enable individuals to go on a self-guided tour.

Throughout the summer, booths and displays were prepared for exhibitions at different locations in the Province. At Windsor, the theme of the display at the Nova Scotia Forestry Exhibition was "Sharing the Forest - Exploration." The Nova Scotia Mineral and Gem Society hosted the Rockhound Rendezvous in Bedford. The display for the Department emphasized gold in Nova Scotia and panning techniques. At the Rockhound Roundup in Parrsboro, the display highlighted rocks and minerals native to the Province and their economic importance. In New Glasgow at the Careers Fair the Department, and Communications Energy, Mines and Resources co-operated in producing a display that described work in the geosciences. A display at MicMac Mall in Dartmouth attracted a large number of viewers interested in rock and mineral identification, and samples of Nova Scotia rocks and minerals. In addition, the display stressed the importance of the mining industry to the economy of the Province. Samples accompanied by descriptions were distributed at all the displays throughout the summer.

The Prospecting in Nova Scotia course continues to be popular. During the 1985 spring session at Dalhousie University, thirty people enrolled in the course which was sponsored by the Department, the Chamber of Mineral Resources of Nova Scotia and the Department of Geology at Dalhousie. The Department and the Chamber, in conjunction with the

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*Funded by Nova Scotia Department of Mines and Energy and the Canada - Nova Scotia Mineral Development Agreement

Colchester - East Hants School Board, are sponsoring the fall course in Truro.

With the support of the CNSMDA Public Information Program, projects are planned to prepare filmstrip presentations outlining the geology, mining and mineral resources of the Province, a photographic record of exploration and mining developments, an advanced prospecting course, video documentaries on the geological development and mineral resources of Atlantic Canada, and newsletters. The Department, under the auspices of the Public Information Program of CNSMDA, has initiated co-operative projects with the Nova Scotia Museum.

ACADIA UNIVERSITY DEPARTMENT OF GEOLOGY RESEARCH

B. Cameron*

Acadia University is located at Wolfville, in the eastern Annapolis Valley about 100 km northwest of Halifax, Nova Scotia. The Geology Department consists of seven full-time professors, two part-time lecturers, two departmental technicians, one demonstrator, one secretary and two part-time research assistants. There are seventy-one undergraduate majors and fourteen graduate students.

The Geology Department emphasizes an integrated field and laboratory approach, and offers instruction and research training leading to bachelors and masters degrees: Bachelor of Science, Bachelor of Science with specialization, Bachelor of Science with Honours and Masters of Science (normally 2 years). All of our undergraduate degree programmes have been revised and all are four-year degrees. Ten of our graduate students are full-time, and eight of our Honours students are in their final year and working on theses. Research funding mainly comes from faculty grants and contracts which are held by most of the staff. All the full-time graduate students also hold fellowships.

Research conducted by the faculty and students is diversified. However, our main thrust is Nova Scotia geology with various projects involving economic geology, igneous petrology, metamorphic petrology, geochemistry, biostratigraphy, paleontology, sedimentology, ichnology, structural geology, regional geology and basin analysis.

The Department has laboratories for the teaching or research of geochemistry, sedimentology, X-ray diffraction, spectrography, paleontology, mineralogy, petrology, structural geology, ore microscopy, photogeology-cartograhy and photomicrography. Our research facilities include two atomic absorption spectrophotometers, X-ray diffraction and fluorescence equipment, research microscopes, computer terminals and microcomputer facilities, a photographic darkroom, nearly 100,000 feet of drill core from Nova Scotia and a thin section preparation centre. Scanning and transmission electron microscopes, mass spectrometer and gas chromatography are available for co-operative use in other science departments, and we make regular use of the University's CYBER 180-830 and Turbodos computers. The Geology Department occupies the third floor and most of the basement of Huggins Science Hall which also contains the Science Library of Acadia University.

FACULTY RESEARCH

Current major research projects of the faculty members are as follows:

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*Departmental Head, Department of Geology, Acadia University, Wolfville, Nova Scotia, B0P 1X0

Professor S. M. Barr Continuing regional mapping programmes in Cape Breton Island and southern New Brunswick; related petrologic studies which emphasize granitoid and volcanic units, and include petrography, geochemistry, age dating and mineral deposit studies.

Professor B. W. Cameron Origin of chert in the Jurassic(?) Scots Bay Formation, Nova Scotia; microbial trace fossils (shell-borings); role of microbes in apparent chemical sediments; barrier island development; modern quartzose stromatolites; age determination of Scots Bay Formation based on newly discovered silicified snails, ostracodes and fossil fresh water algae; subsurface stratigraphy of the Blomidon and Wolfville Formations in the Annapolis Valley.

Professor J. A. Colwell Mineral deposits; clay mineralogy; geology of the North Mountain basalt.

Professor R. G. Moore Biostratigraphy of the Windsor Group in the Parrsboro-Upper Economy area, and Cumberland and Colchester Counties, Nova Scotia; mapping with S. Ferguson at scale 1:10 000 of Windsor-Martock, St. Croix - Panuke Lake and Mosherville quadrangles for Nova Scotia Department of Mines and Energy.

Professor R. P. Raeside Stratigraphy, deformation and metamorphism of metasedimentary rocks of the Cape Breton Highlands; continuing regional mapping of the Cape Breton Highlands; metamorphism of Meguma Group, southwest Nova Scotia.

Professor G. R. Stevens Interpretation of remote sensing imagery for megastructural and economic geological applications; computer graphics in structural analysis; primary structures of igneous rocks; mesostructure and microfabric of deformed rocks; participating with J. Colwell in clay mineral diagenesis project (see above); geological parameters for radioactive waste depositories.

Professor N. A. Van Wagoner Determination of the pre-Carboniferous tectonic evolution and metallogenesis of the northern Appalachians based on detailed studies of the physical volcanology, stratigraphy and sedimentation of volcanic and volcaniclastic rocks of Cape Breton Island and southern New Brunswick; the origin and volcanism of the Alpha Ridge, Arctic Ocean; the structure and evolution of the North Atlantic Oceanic crust; volcanism and paleomagnetic stratigraphy of subglacial basalts in Iceland; physical volcanology and metallogenesis of the Proterozoic Flin Flon - Snow Lake greenstone belt; estuarine sedimentation as it relates to the potential for tidal power developement; geological studies of the Lithoprobe East transect.

Part-Time Lecturers

Dr. M. S. Akhavi Nova Scotia Land Survey Institute, conducts lectures on airphoto interpretation and remote sensing.

Mr. Steven Van Wagoner Currently finishing a Ph.D. degree in sedimentology from University of Manitoba and is teaching hydrology at Acadia.

DALHOUSIE UNIVERSITY
DEPARTMENT OF GEOLOGY

The Department of Geology at Dalhousie University conducts a complete program of undergraduate (B.Sc. and B.Sc. (Honours)) and graduate (M.Sc. and Ph.D.) instruction. The undergraduate teaching program is organized to provide the academic and professional needs of both students and industry. We pride ourselves in our established reputation of producing geologists who are prepared, upon graduation from undergraduate program, to work as professionals in the mining and petroleum industries. The graduate program provides opportunities for qualified people to participate in the on-going research activities of this Department.

We carry out a vigorous research program that is relevant to the Nova Scotia geological setting, continental shelf, adjacent deep ocean floor and matching terranes on the other side of the Atlantic. The research is focused on the related problems of Appalachian mountain building and metallogenic processes, passive continental margins, adjoining oceanic floor and geological correlation with western Europe and northwestern Africa. Studies involve both ancient and modern environments.

Dalhousie University is one of Canada's leading marine research centres and it maintains an extensive research program in marine earth science. Included in the marine earth science projects carried out by faculty and students at the Centre for Marine Geology are the Ocean Crust Studies, the Cyprus Crustal Study Project and the Ocean Drilling Project.

The Department graduates, yearly, about 14 B.Sc.(Honours) in Geology, of which up to four are specialized in Geophysics.

During the 1985-86 session, the Faculty consists of the following individuals. Their present main teaching activities and research interests are indicated:

Ron Boyd	Sedimentology, Deltas, Coastal Processes.
D. Barrie Clarke	Mineralogy, Igneous Petrology, Peraluminous Granites.
Martin R. Gibling (Undergraduate Advisor)	Clastic Sedimentology, Basin Analysis, Models for Oil Shale Environments.
Jim M. Hall (Director, Centre for Marine Geology)	Tectonics, Paleomagnetism, Ocean Crust Studies, Third World Development
Rebecca Jamieson	Metamorphic Petrology, Tectonics, Structural Geology.
Franco Medioli	Micropaleontology, Taxonomy, Sealevel Changes.
Gunter Muecke	Geochemistry, Metamorphic and Igneous Petrology, Hydrothermal Processes.

Brian O'Brien (Lecturer)	Structural Geology, Appalachian Geology and Tectonics.
Peter H. Reynolds	Geophysics, Astronomy, Geochronology, Isotope Geology.
Paul T. Robinson (Director, O.D.P., Mobil Research Professor)	Igneous Petrology, Volcanology, Ophiolites, Ocean Drilling Project.
Patrick J. C. Ryall (Graduate Studies Co-ordinator)	Geophysics, Exploration Geophysics, Marine Paleomagnetism, Ocean Drilling Technology.
Matthew Salisbury (PetroCanada NSERC Professor)	Marine Geophysics, Deep Crustal Physical Properties, Deep Sea Drilling Project.
Paul E. Schenk	Sedimentology, Sedimentary Tectonics, Carbonate and Evaporite Environments.
David B. Scott	Micropaleontology, Marine Geology, Sea Level Changes, Sable Island.
Marcos Zentilli (Chairperson)	Economic Geology, Metallogeny, Volcanology.
Peter Wallace (Senior Instructor)	Field Geology, Physical Geology, Prospecting Course, Geology of the Cobequid Highlands.

Honourary Adjunct Professors

J. Sebastian Bell	(A.G.C. - B.I.O.)	Petroleum Geology and Resources
F. Gradstein	(A.G.C. - B.I.O.)	Biostratigraphy, Micropaleontology
Peter Hacquebard	(A.G.C. - B.I.O.)	Coal Geology
Lubomir Jansa	(A.G.C. - B.I.O.)	Stratigraphy, Carbonates, Tectonics
David J. W. Piper	(A.G.C. - B.I.O.)	Sedimentology, Marine Geology

Research Associates

Christopher Beaumont	(Department of Oceanography)	Evolution of Basins, Geophysics

Honourary Research Associates

Peter S. Giles	Nova Scotia Department of Mines and Energy
Charlotte Keen	Atlantic Geoscience Centre, Bedford Institute of Oceanography
Charles T. Schafer	Atlantic Geoscience Centre, Bedford Institute of Oceanography

For more information please contact:

Chairperson
Department of Geology
Life Sciences Centre
Dalhousie University
Halifax, Nova Scotia
B3H 3J5

ST. FRANCIS XAVIER UNIVERSITY
DEPARTMENT OF GEOLOGY

GENERAL

St. Francis Xavier University is located in Antigonish, about 150 miles east of Halifax. The Geology Department consists of six staff members and approximately fifty majors.

The geology program is designed to provide a **strong fundamental background** for students who continue to graduate study and at the same time, to provide enough operational practical training to equip those who are immediately employed as professional geologists.

Our geology curriculum reflects this aim. Courses such as Mineralogy, Crystallography, Petrology, Stratigraphy and Sedimentation, and Structural Geology are specialized and basic. Applied courses include Ore Deposits, Petroleum Geology, Coal Geology, Geophysics and Geochemistry. The latter provide an opportunity to use and to elaborate on the basic principles encountered in earlier geology courses and courses, especially physics, chemistry and mathematics, obtained outside this Department. There is a seminar course for senior students that is directed to developing the students' capacity to formulate a problem, devise a plan of attack, execute the plan, and to report the results both orally and in written form. Figure 1 illustrates how the various courses are interwoven to form a coherent whole.

LABORATORY STUDIES

We view the field as the most important means of laboratory instruction. To bring together textbook and actual occurrence, certain laboratory periods are devoted to examination in the field. As expected, this is subject to seasonal restrictions.

In a number of branches of the earth science, three-dimensional visualization is extremely important. In Mineralogy, training in three-dimensional visualization is promoted by the use of crystal models, lattice models and the examination of minerals in their actual crystalline form. In Structural Geology, the three-dimensional training is continued through the use of descriptive geometry and stereographic projection.

Other aspects of laboratory work include the examination of thin sections under the petrographic microscope, analyses of structures on maps, and geochemical analyses including work on radiometric dating of rocks.

FIELD CAMP AND SUMMER EMPLOYMENT

At the end of the sophomore year all students are strongly urged to attend the ten-day spring field camp held annually at St. Francis Xavier. The camp forms the core of a field methods course which also involves numerous mapping projects during sophomore, junior and senior years.

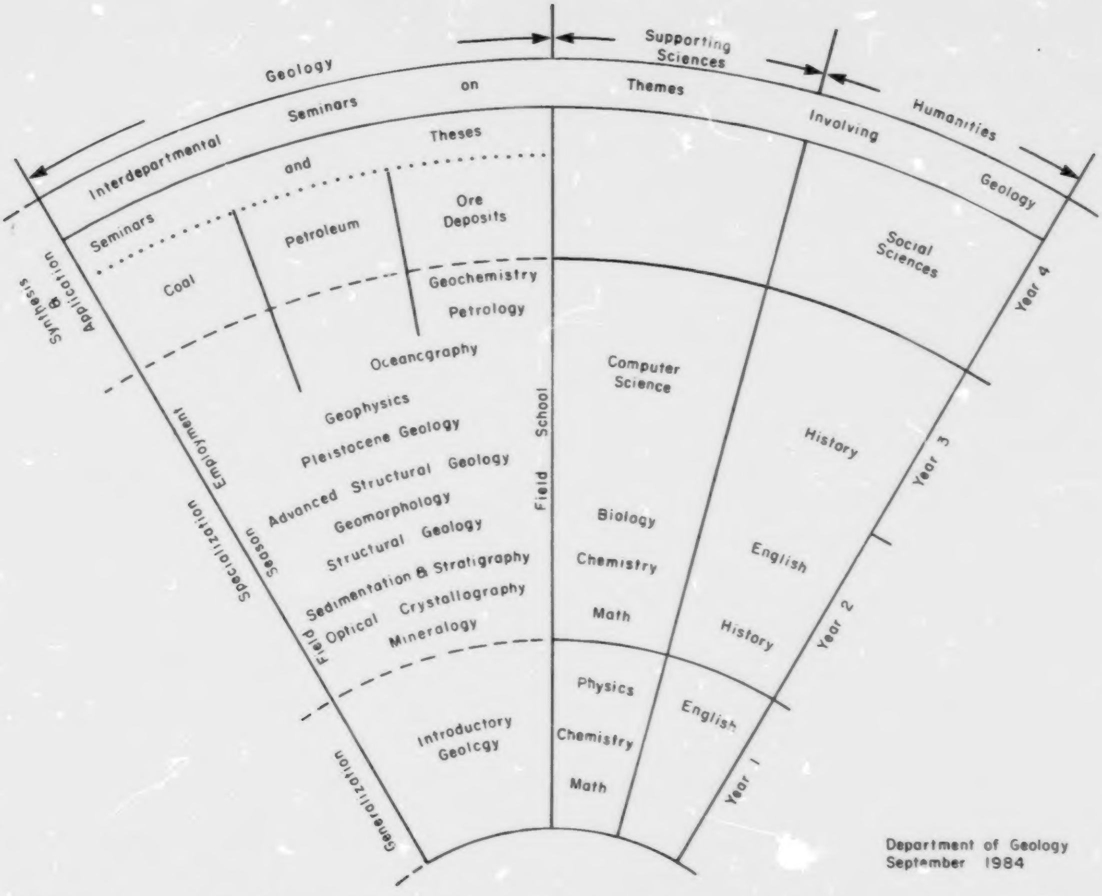

Figure 1. Interrelationship of courses at Saint Francis Xavier University.

In addition many geology students obtain employment in geological work during the summer We regard this as an effective extension of their classroom and laboratory experience.

FACULTY

Here is a brief outline of the geology teachers at St. Francis Xavier University.

R. F. Cormier, Ph.D. (M.I.T.), has taught at St. Francis Xavier for 25 years. He teaches courses relating to the basic constituents of rocks and he also teaches geochemistry. The age determination of rocks, using the ratio of radioactive rubidium to strontium, is his major research activity.

K. Greenidge, Ph.D. (Harvard), teaches introductory courses in oceanography, geomorphology and Pleistocene geology. His research interests combine oceanography, botany and Pleistocene geology. Northern Cape Breton, Aspy Bay and northern mainland Nova Scotia have been the locale of much of his research effort.

William S. Shaw, Ph.D. (M.I.T.), is Chairman of the Department and teaches oil and gas geology, coal geology, stratigraphy and geophysics. He came to St. Francis Xavier after a long career in oil exploration. Oil, coal, salt and ore deposits are his chief research interests.

H. C. Teng, M.Sc. (Memorial), will receive his Ph.D. this year from the University of New Brunswick. Professor Teng teaches fundamental properties and recognition of minerals, in addition to structural geology and ore deposits. A strong background in applied mining geology, together with his research interest in ore deposits, make his courses particularly effective.

J. Brendan Murphy, Ph.D. (McGill), teaches courses concerning the origin of igneous and metamorphic rocks, regional structural geology and optical mineralogy. His research interests at present concern the geological evolution of the Antigonish Highlands area and the evaluation of its mineral potential.

Cynthia Murphy, B.Sc. (McGill), is completing her M.Sc. thesis with McGill. At present, she is instructing sedimentology and is responsible for laboratories in advanced courses. Her current interest is the geology of the Gaspé Peninsula in Quebec where she is studying the magmatic history of granitic and volcanic rocks.

SAINT MARY'S UNIVERSITY
DEPARTMENT OF GEOLOGY

The Geology Department of Saint Mary's University offers a complete undergraduate program leading to geology major and honours degrees. The Department consists of five faculty members, four part-time instructors and two full-time technicians. Average enrollment is about 50 geology majors and seven honours students.

Research facilities in the Geology Department include equipment for X-ray fluorescence and neutron activation analysis, photomicroscopy, thin section preparation and rock crushing, labs for geochemistry, micropaleontology and sedimentology, and a darkroom and drafting room. Students also have access to the University VAX-11 computer.

RESEARCH PROJECTS

J. Dostal is involved in a geochemical and petrological study of Precambrian volcanic rocks of Nova Scotia and New Brunswick. This investigation of rocks from the Fourchu, Stirling, East Bay Hills, Coxheath and Caledonia belts focuses on the identification of ancient tectonic regimes in the Maritime section of the Avalone Zone.

G. **Pe-Piper** is studying Hadrynian and Paleozoic igneous and metamorphic history of the Cobequid Hills and petrology, stratigraphy and isotopic interpretation of Cretaceous and Triassic igneous rocks, offshore southeast Canada.

Q. A. Siddiqui is carrying out research on Late Cenozoic ostracods from drill sites in the MacKenzie delta and Beaufort Sea on Early Cretaceous ostracods from southern Alberta.

J. W. F. Waldron is continuing to work on deformed sedimentary rocks in the Canadian Appalachinas. He is studying the deformation of allochthonous continental margin sediments in western Newfoundland, and the sedimentology of Meguma Group turbidites in Nova Scotia.

D. H. Williamson is Dean of Science. As well, he teaches introductory geology courses. His research interest centres on mineralogy and crystallography, particularly crystal structures.

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THE MINERAL TECHNOLOGY PROGRAM
UNIVERSITY COLLEGE OF CAPE BRETON
SYDNEY, NOVA SCOTIA

H. R. Oldale*

INTRODUCTION

The Mineral Technology program was established in 1968 as part of the Nova Scotia Eastern Institute of Technology, a forerunner of the present University College of Cape Breton, and graduated its first class in 1970. Since then some 116 students have obtained their diplomas and may be found employed throughout Canada in all aspects of the mining and petroleum industries. Many of the earlier graduates now occupy senior technical and management positions. Initial employment within three months of graduation show 22 per cent of the graduates are employed in exploration, 22 per cent in production, 17 per cent in processing, 11 per cent in other related employment (sales and service industries) and 8 per cent in unrelated employment. Some 11 per cent have continued university studies while 9 per cent are unemployed for three months or longer.

OBJECTIVES

The curriculum objectives of the program reflect the employment distribution. It is designed to provide a strong fundamental background for technical employment in the exploration, production and processing phases of the mineral industry. The course spans two years or 20 months (2400 hours) with the student graduating as a Mineral Technologist (Dipl. T.). Present plans for future development include the addition of another two years to provide a Bachelor of Technology degree (B.Tech.) and adopting the co-op mode for the diploma program. A mining geology degree is also being investigated in co-operation with another university geology department.

Integrated field work and industry visitation are fundamental components of the program. Three-dimensional visualization, analytical problem solving and use of computers are stressed. Several courses are project oriented leading to a final report. These include exploration methods and a mine feasibility study. In addition to visiting local mineral industry operations, one week in October of the second year is devoted to visiting mining operations in other areas of the Province and New Brunswick.

An industry advisory committee, meeting twice a year serves to keep the program current and up-to-date. The committee comprises some sixteen senior personnel representing industry, government and educational institutions throughout Nova Scotia and New Brunswick.

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*Mineral Technology, University of College of Cape Breton, Syndey, Nova Scotia

MINERAL TECHNOLOGY CURRICULUM

TERM 1:		Theory hrs./wk.	Lab. hrs./wk.
59-011	Math I	3	
59-001	Communications I	2	
59-021	Physics I	2	3
59-031	Drafting I		3
54-001	Surveying I	2	3
50-051	General Chemistry	3	3
54-021	Geology I	3	3
		15	15

TERM 2:		Theory hrs./wk.	Lab. hrs./wk.
59-032	Drafting		3
59-012	Math II	3	
59-022	Physics II	2	3
59-002	Communications II	2	
59-042	Computer Programming		2
50-052	Chemistry II	2	2
54-032	Mining, Oil and Gas	2	
54-022	Geology II	3	3
		14	13

TERM 3:		Theory hrs./wk.	Lab. hrs./wk.
59-013	Math III	3	
54-003	Surveying II	2	3
54-023	Geology III	3	3
54-043	Mineral Processing I	2	3
54-053	Exploration Methods I	2	3
54-063	Surface Mining I	2	3
54-073	Underground Mining I	3	
54-083	Assaying I	1	3
		18	18

TERM 4:		Theory hrs./wk.	Lab. hrs./wk.
54-014	Math IV	3	
54-024	Geology IV	3	3
54-044	Mineral Processing II	2	3
54-054	Exploration Methods II	2	3
54-064	Surface Mining II	2	3
54-074	Underground Mining II	3	
54-084	Assaying II	1	3
		16	15

FACULTY

H. R. Oldale, B.Ed., M.Sc., P.Eng., the senior member, joined the Department in December 1967 to set up the program prior to it opening in September 1968. Before 1967 he had spent ten years in geology, mine engineering, development and exploration management. He presently teaches geology and exploration methods.

H. E. Slaunwhite, B.Eng., B.Ed., P.Eng., a mining engineer, has taught in the program since 1969 after working 10 years in mining operations and industrial engineering throughout Canada. He presently teaches mineral processing, mining, computer programming and surveying.

F. M. Isenor, Dipl.T., B.Sc., a mining geologist, joined the Department in 1981. He is a former graduate of the Mineral Technology program and has had seven years industry experience in exploration work and coal mining geology. His teaching responsibilities include geology, surveying and assaying.

C. P. Nicholson, Dipl.T., is a graduate of the Mineral Technology program. He joined the faculty in 1981 after eight years experience in local mining and construction. His teaching duties include laboratory instruction in geology, mining, surveying, computers and exploration, in addition to laboratory maintenance and purchasing responsibilities.

NOTE: In addition, geology is taught to civil, environmental and chemical technology students, computer programming to chemical technology students, and environmental technology and surveying to enviromental technology students.

NOVA SCOTIA INSTITUTE OF TECHNOLOGY PETROLEUM RESOURCES TECHNOLOGY PROGRAM

P. Batson*

INTRODUCTION

The Petroleum Resources Technology (P.R.T.) program has a two year duration and 20 students are accepted. It has been designed to cover the fields of drilling, completions and workovers, production operations, and geology and reservoir studies.

The P.R.T. program was initiated in 1981 and the first graduates entered the job market in June 1983. Fortunately, all of these graduates were successful in gaining industry related employment in a very tight job market. Since 1983, there have been two graduating classes. The 1984 class had 95 per cent placement and 4 of 13 have been employed locally. The bulk of the graduates have been employed locally with service companies or drilling contractors. Some companies that have hired graduates are Bow Valley Offshore, Exlog, Nowsco, Dowell Schlumberger, Geo-Vann Services, Haliburton, Swaco, Magcobar Data, Baroid, Sedco, Computing Gearhart, Technifluids, ESSO, and Petro Canada Exploration in Calgary.

We feel the scope of the Petroleum Resources Technology program is sufficient to provide the students with knowledge which enables them to adapt to the employee requirements of drilling contractors, oil and gas exploration companies, government regulatory agencies, and oilfield supply and service companies.

We emphasize the transferability of the students' acquired knowledge, so they are willing to move where the employment opportunities present themselves. That is why we are encouraging our 1985 graduates to seek employment in Saskatchewan or Alberta. We invisage in the near future a downturn in the local industry activity but a potential resurgence if and when production of the offshore gas becomes a reality. When this happens our graduates will have the required experience to confidently meet the demands of the offshore development and will be able to return.

PROGRAM DESIGN

INSTRUCTIONAL STAFF

Full time (3)
(1) vacancy
Borrowed from other programs (4)

MAJOR DISCIPLINES COVERED

	Emphasis
Geology	Exploration and Development
Drilling	
Production	Development
Reservoir	

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*Nova Scotia Institute of Technology, Halifax, Nova Scotia

Geology

This discipline introduces the students to the basic concepts of geology. The students learn how to identify rocks and minerals in the lab and in the field. As the program progresses they are exposed to more petroleum applications of geology and are required to identify and describe cuttings using binocular microscopes.

A support course to the Geology discipline is Formation Evaluation. The student learns to systematically analyze mechanical logs and learns the capabilities of a majority of logging devices. The course is augmented with a tour of one of the service company's facilities.

Drilling

This discipline introduces the student to the equipment used in rotary drilling operations, both on land and offshore. This is supported by a tour of a rig when the opportunity presents itself. As the course progresses the students conduct a number of 'hands-on' experiments in the lab dealing with such topics as cementing design and additivies (use of the cement consistometer), casing design, drilling mud formulation and testing. More advanced topics deal with drilling hydraulics, directional drilling, drillsite data, monitoring and instrumentation, as well as 'straight' hole drilling operations.

Production

This part of the program is divided into two components: Production Operations, and Completion and Workover Operations. The Production Operations component deals with an engineering approach to topics such as wellheads, perforating, packers, treaters and separators (of which we have a working model in the lab). As the students progress they cover more advanced topics like hydrate formation and prevention, compressor station design and operation, dew point testing and flash separation (done in the lab), and gas plant processing. Other topics consist of determination of bottom hole pressures, drill stem test procedures and analysis of deliverability testing of gas wells. Evaluation of oil well productivity, two phase flow and artificial lift methods are discussed, as well as determination of reservoir and well data, such as permeability transmissibility, skin damage and boundaries. The Completion and Workover Operation component deals with tubing and well head design, down-hole equipment and operations, formation damage, and stimulations and service rig workovers.

Reservoir

This component of the program focuses on determination of oil and gas reserves by volumetric and material balance methods. Enhanced recovery methods are covered in addition to recognition and performance of primary recovery schemes. The student is exposed to reservoir lab techniques such as use of the porosimeter and the permeameter in our lab facilities. The student is also introduced to pressure build-up analysis and fluid flow in the reservoir.

SUPPORT COURSES

In addition to the core disciplines covered in the P.R.T. program there are a number of support courses offered, throughout the two year program, to augment the major disciplines. A number of Applied Mathematics and Calculus courses support the other disciplines. The Communication Skills course forms a very important thread for the P.R.T. program, because it is essential the student be able to communicate verbally and in technical report writing. Each student is placed outside the Institute with a supervisor and is required to write a major technical report on a topic suitable to both parties. Two computer related courses include Computer Programming and Computer Workshop. These essentially introduce the students to the BASIC language, make the students computer literate and allows them to use existing software packages for problem solving. Recently, some HP 9000 series equipment was installed with an expandable capability. In time, the gradual integration of the computers with the practical problem solving applications of the other disciplines is intended. Applied Chemistry is an important part of the support course load. Many experiments are conducted in the lab environment. Some topics covered deal with various solutions, components of naturally occurring petroleum fluids, some field process operations and corrosion control. Phase behaviour of hydrocarbon liquids and gases, the gas laws, and some process operations are covered. Drafting fundamentals are covered. Petroleum Economics is another support course.

In addition to our own facilities the P.I.T.S. B.O.P. well control simulator is located in the same building. There has been an informal arrangement with P.I.T.S. whereby students have received a demonstration on the well control simulator. The simulator consists of a mockup of a drilling floor with choke valves, manifold, driller's console, brake, B.O.P. panel, and computer simulated motion compensator with colour monitor showing downhole and surface activity.

REMOTE SENSING GEOLOGICAL INVESTIGATIONS NOVA SCOTIA LAND SURVEY INSTITUTE

M. S. Akhavi*

The Nova Scotia Land Survey Institute provides an opportunity for students enrolled in the Remote Sensing Program to undertake co-operative projects in their area of expertise with the assistance of an external agency. These projects are normally selected and defined by outside agencies. They involve 800 hours or more of student time, supervision and utilization of computing, image analysis, darkroom, cartographic and other facilities existing at the Institute. A member of the co-operating agency normally acts as external advisor and as a source of data. Therefore, these projects are of no direct cost to the external agency.

The following is a list of seven remote sensing, geological projects conducted under my supervision at the Nova Scotia Land Survey Institute during the academic year 1984-85:

1. Structural and surficial geological investigation of the Musquodoboit Batholith, Nova Scotia, utilizing remote sensing techniques

Objective:	To determine the utility of remotely acquired data for structural analysis, surficial mapping, and differentiation and identification of granitic bodies.
Investigator:	James A. Genereux
External Advisor:	Mr. D. R. Duncan, Kidd Creek Mines Limited

2. The interpretive analysis of remotely sensed data for the delineation of overburden, geological and fracture characteristics of the Hagersville Mine, located near Hagerville, Ontario

Objective:	Classification and assessment of overburden categories, moisture anomalies, and interpretation of hazard zones and water inflow into a gypsum mine.
Investigator:	Robert Hingley
External Advisor:	Mr. W. L. Lewis, Canadian Gypsum Company Limited

3. Geobotanical investigations utilizing remote sensing techniques - Guysborough Area, Nova Scotia

Objective:	Detection of the association of rock types and geological structures with botanical land cover; identification of mineral occurrences and their relationship with geobotanical signatures.
Investigator:	Thomas F. Johnson
External Advisor:	Mr. V. R. Slaney, Geological Survey of Canada

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*Senior Instructor, Remote Sensing Program, Nova Scotia Land Survey Institute, Lawrencetown, Nova Scotia, BOS 1M0

4. Structural analysis utilizing remote sensing techniques - Prince Edward Island

Objective: Detection of geological structural features and preparation of an interpretive geological map of the Island.
Investigator: Kelvin A. Kedves
External Advisor: Mr. W. MacQuarrie, Department of Energy and Forestry, Prince Edward Island
Committee Member: Mr. J. F. Wightman, Vice-Principal, Nova Scotia Land Survey Institute

5. Geocoded database investigations utilizing remote sensing techniques - Guysborough Area

Objective: Integrated analysis of geological, airborne radiometric and remotely sensed data to detect rock type/structural features and target areas pertinent to mineral occurrences.
Investigator: Terrence R. McInnis
External Advisor: Mr. V. R. Slaney, Geological Survey of Canada

6. Geological investigations utilizing remote sensing techniques - East Kemptville Area, Nova Scotia

Objective: Utilization of MSS, TM and Thermal IR data to detect structural and lithological trends favourable to mineral emplacement.
Investigator: Brian D. McPherson
External Advisor: Mr. Avard Hudgin, Maritime Exploration Limited
Dr. Duncan Keppie, Nova Scotia Department of Mines and Energy
Committee Member: Mr. J. F. Wightman, Vice-Principal, Nova Scotia Land Survey Institute

7. Geological mapping and structural interpretation of Lunenburg County, Nova Scotia utilizing remote sensing techniques

Objective: To examine the attributes and limitations of remotely acquired data for detection of the geological configuration and structural framework of Meguma Group rocks.
Investigator: Brent R. Rowley
External Advisor: Dr. B. H. O'Brien, Hi-Tec Geoconsultants Limited

The results of these investigations are compiled in the form of a final report containing geological maps, graphics, color slide enhancements of Landsat and other types of data. These reports are available at our library for public use.

The co-operative project is an integral part of the remote sensing training at our Institute. We welcome proposals pertaining to the investigation of both non-renewable resources or environmental monitoring problems, or both.

SUBSURFACE STRATIGRAPHY OF THE LATE TRIASSIC WOLFVILLE SANDSTONE AND BLOMIDON SHALE OF THE FUNDY BASIN: ANNAPOLIS VALLEY, NOVA SCOTIA

B. Cameron* and W. Jong*

The sedimentology and stratigraphy of the Late Triassic upper Wolfville Sandstone and Blomidon Shale Formations of the central Annapolis Valley are under investigation (Jong, 1985). Due to paucity of outcrop, emphasis is being placed on diamond-drill cores donated by Getty Mines Limited to the Acadia University Geology Department. From 1976 to 1978, Getty Mines Limited completed about 9625 feet (2934 metres) of diamond-drilling in 15 vertical holes in the central part of the valley. Most were short holes drilled in the valley, but four deeper holes penetrated the North Mountain Basalt, the underlying Blomidon Shale and upper Wolfville Sandstone. The latter holes provide a north-south cross-section beneath North Mountain. Some holes were radiometrically logged.

The Wolfville Sandstone is composed mostly of massive, fine- to medium-grained red sandstones. Current laminations are present but obscure. Poorly sorted conglomerates, siltstones and mudstones also occur. These sediments are interpreted to have been sheetflood deposits with minor stream channel and debris flow deposits. The upper Wolfville Sandstone was deposited mostly on a lower-middle to distal alluvial fan environment.

The Blomidon Shale is primarily composed of red, calcareous, massive, playa lake mudstones. Minor amounts of sheetflood derived sandstones and very fissile shales deposited in short-lived lakes also occur. Sheetflood sands, gypsum nodules, mudcracks, adhesion sands and other features indicate the depositional surface of the playa mudflats was frequently exposed to fluvial and subaerial processes. The problematic trace fossil *Dendrophycus triassicus* is reported for the first time from the Fundy Basin.

Study of the surface textures of selected samples of well-rounded quartz sand grains, using scanning electron microscopy, indicates that surface textural features diagnostic of diagenesis and hot deserts are dominant. Some grains also show surface features indicative of fluvial transport. Evidence of aeolian transport is predominant on the well-rounded grains from the Blomidon Shale Formation.

A preliminary stratigraphic cross-section, based on core and outcrop data near Central Clarence, indicates there may not be any major facies change between the Wolfville and Blomidon Formations in the Annapolis Valley, as suggested by Klein (1962).

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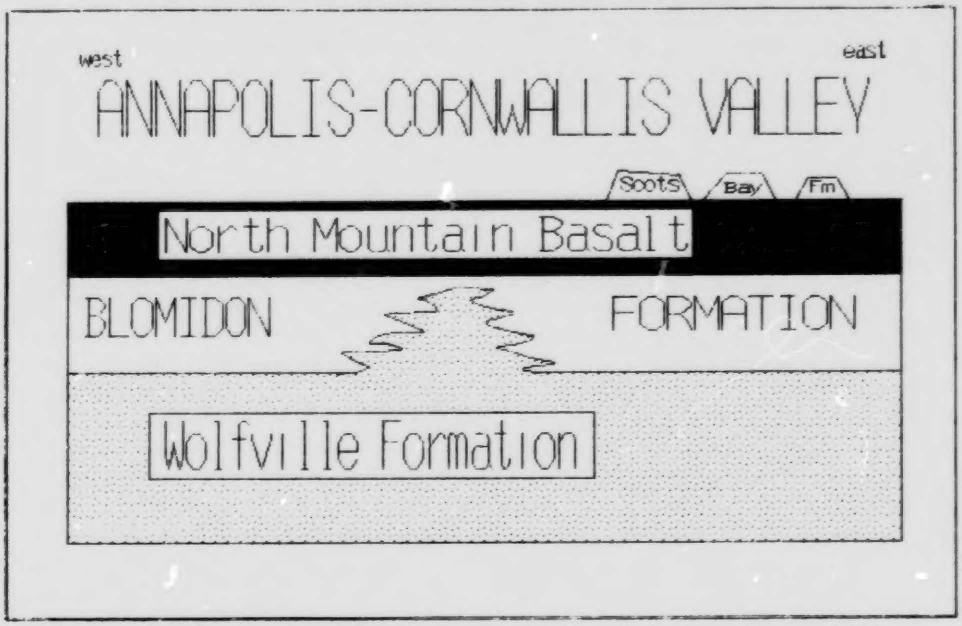
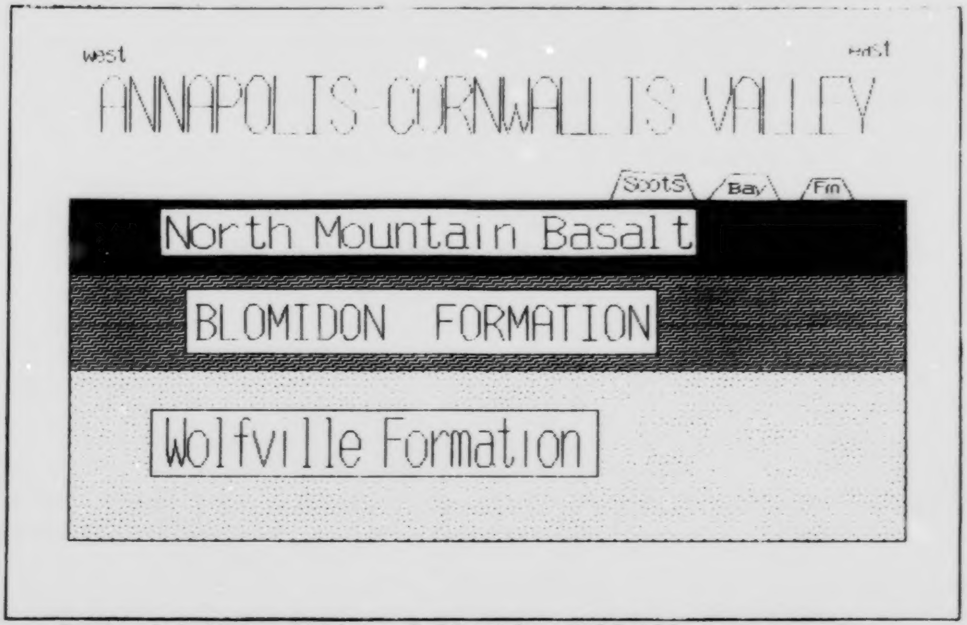


Interpretation of a Blomidon-wolfville facies relationship within the central Annapolis Valley (Klein, 1962)



Revised interpretation of Blomidon-Wolfville relationships within the central Annapolis Valley (this paper)

GEOLOGICAL MAPPING OF THE NORTH MOUNTAIN, NORTHERN CAPE BRETON HIGHLANDS, NOVA SCOTIA*

R. P. Raeside, S. M. Barr**, C. E. White** and F. A. R. Dennis****

During 1985, geological mapping in the northermost Highlands of Cape Breton Island continued as a project involving mapping and petrologic studies of the Precambrian and Paleozoic crystalline rocks of the entire Highlands (Raeside et al., 1984; Barr et al., 1985). The 1985 map area is bounded by the Gulf of St. Lawrence and Atlantic Ocean on the west, north and northeast, by the Aspy Fault on the southeast and by the Grande Anse valley on the south. The map area can be subdivided into two zones of different lithologic character. The bulk of the area, west of a fault zone, recognized in the valleys of Wilkie and Grays Hollow Brooks, is composed of an undivided package of felsic and mafic gneiss, and a series of plutonic rocks of variable composition and development of foliation. East of the fault zone the diversity of lithologic types is less extreme and the rocks consist of predominantly felsic gneiss and schist, and felsic granitoid rocks. Approximately 30 per cent of the area is underlain by Upper Paleozoic sedimentary rocks of the Horton and Windsor Groups which were not mapped in detail.

The main components of the western gneissic complex are quartzofeldspathic gneiss, amphibolite and granitic gneiss. These lithologies are intermixed and it has not been possible to separate them on a 1:50 000 scale map. Anorthosite occurs in small plutons and dykes within the gneissic complex in the central and western parts of the map area. Mapping has redefined the distribution of previously mapped anorthosite, identified the presence of a major additional body and established the intrusive relationship between anorthosite and the gneissic complex. Mappable bodies of monzodiorite occur in apparent close association with anorthosite in the southern part of the map area. These are intruded by abundant dykes and small plutons of syenite and granite. Syenite also forms a large intrusion in the northern part of the map area. This unit is particularly significant because the Meat Cove zinc deposit, as well as other sulphide showings, occur in association with marble xenoliths within the syenite.

Two major units of stratified rocks are recognized between Wilkie Brook and the Aspy fault systems: the predominantly gneissic Cape North Group and the predominantly schistose Money Point Group. These groups were originally identified by Macdonald and Smith (1980) in the Cape North peninsula and can be traced south from the peninsula in a continuous belt for 15 km. The rocks of the Cape North Group include a wide variety of lithologies, but are characterized by the ubiquitous presence of gneissic semipelitic and pelitic lithologies. In addition, there are substantial amounts of amphibolitic rocks and smaller amounts of psammitic and calcareous lithologies. All of these lithologies are intruded abundantly by granitoid sheets and lenses. The Money Point Group consists of low to

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*Funded by Geological Survey of Canada under the Canada - Nova Scotia Mineral Development Agreement

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medium grade pelitic and semipelitic rocks with minor amounts of psammitic and mafic rocks. The predominantly volcanic sections identified by Macdonald and Smith (1980) do not occur in the area to the south. All the rock types in the group are closely interbedded and therefore it has not been further subdivided.

In addition to the lithologies described above, abundant granitic plutons, and granitic and mafic dykes are found throughout the map area. Rhyolites and associated units of the Fisset Brook Formation occur locally around the periphery of the crystalline rocks.

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THE DEEP COVE PLUTON AND ASSOCIATED POLYMETALLIC MINERALIZATION GABARUS BAY, CAPE BRETON ISLAND*

F. A. R. Dennis**

The Deep Cove Pluton and Fourchu Group rocks at Gabarus Bay, Cape Breton Island were studied in detail in the summer of 1985 as part of an Acadia University M.Sc. Research Program. The study included four weeks of field mapping at Gabarus Bay and four weeks of logging drill core at the Nova Scotia Department of Mines and Energy core library in Stellarton. Drill core from a total of 22 holes was logged. The holes were drilled in the Pluton and in the adjacent country rock to delineate alteration zones containing polymetallic (Ag-Bi-Cu-Pb-Zn) mineralization.

The Deep Cove Pluton intruded the Late Precambrian rocks of the Fourchu Group, a complex sequence of mainly pyroclastic rocks of predominantly intermediate composition. Preliminary results of petrographic and geochemical studies indicate the Pluton is a variably altered porphyritic granite with phenocrysts of plagioclase in a fine grained granitic groundmass. Two other intrusive units are also identified: (1) a series of randomly oriented rhyolitic dykes ranging in width from less than one metre to over five metres wide and (2) a fine grained equigranular granite dyke of unknown dimensions (observed at a depth of approximately 270 metres in a single drill core). Alteration within the Pluton is complex, with zones up to 15 metres wide of quartz-sericite-pyrite greisenization displaying complete destruction of original texture, separated by zones of less intense alteration where the principle alteration products include sericite, chlorite and potassium feldspar. Alteration generally decreases with depth and strongly altered zones occur as lenses rather than uniform horizons.

Mineralization is of two main types: (1) simple molybdenite occurring in quartz veins and as disseminations and (2) polymetallic mineralization (pyrite, pyrrhotite, chalcopyrite, sphalerite, molybdenite and bismuthinite) occurring as veins and fracture coatings. Polymetallic mineralization is associated with zones of stronger alteration.

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*Funded by EMR Research Agreement and NSERC grants to S. M. Barr

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GEOLOGICAL MAPPING AND IGNEOUS AND METAMORPHIC PETROLOGY, QUEENS AND SHELBURNE COUNTIES, NOVA SCOTIA*

T. L. Hope ** **and S. L. Woodend*****

Cambro-Ordovician turbiditic sequences of the Meguma Group have been deformed and regionally metamorphosed during the Acadian Orogeny producing upper greenschist to middle amphibolite facies schists and granofels. The intrusion of the Devonian Port Mouton Pluton further increased metamorphic grade around the margin to sillimanite zone assemblages.

The Goldenville Formation consists of thickly bedded psammite containing calcsilicate lenses, psammite interbedded with semipelitic schists, and minor slate and conglomerate. The psammite is medium grey, fine- to medium-grained and contains metamorphic biotite. Aluminous semipelitic schists contain porphyroblasts of biotite, garnet, andalusite, cordierite or staurolite. A quartz pebble (granule) conglomerate with rare randomly distributed three to four centimetre long quartz pebbles is exposed along the west side of Lockeport Harbour near Western Head.

The Green Bay formation is exposed in the Broad River Valley. The base is defined by the disappearance of one to two metre wide beds of psammite of the Goldenville Formation and the top is defined by the appearance of grey-black slate of the Halifax Formation. It can be subdivided into a lower and upper member. The lower member is composed of 15 to 20 cm wide beds of psammite finely interbedded with psammite, and andalusite or staurolite (or both) schist. The upper member is composed of finely bedded (1 to 2 cm) psammite with interbeds of andalusite schist. Within these beds, pink coticule nodules (2 to 3 cm in diameter) are found. They are composed of spessartine garnet and quartz.

The Halifax Formation ranges from a grey-black slate along the Broad River Valley to an andalusite-cordierite-staurolite granofels or schist with interbedded psammite exposed along the Jordan River Valley. This variation is a product of different metamorphic grades and protoliths.

The Port Mouton Pluton is a complex intrusion with at least nine distinct cross-cutting units. The lithologies range from tonalite to granodiorite and granite, are predominantly equigranular, fine- to coarse-grained and contain varying proportions of country rock fragments. Pegmatite dykes with associated fine grained garnet aplite are common at the contact between the Pluton and surrounding country rocks of the Goldenville Formation.

Beryl and traces of molybdenite are present in pegmatite dykes with molybdenite also present in quartz-muscovite-andalusite veins cutting the Green Bay formation.

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GEOLOGY AND PETROGENESIS OF THE PLUTONIC ROCKS OF NORTH MOUNTAIN, CAPE BRETON ISLAND*

M. F. Justino**

North Mountain covers a 6 x 24 km area, bordering on Bras d'Or Lake, located about 35 km northeast of Port Hawkesbury, Cape Breton Island. During the 1985 field season the study area was mapped and sampled as a basis for an M.Sc. thesis at Acadia University.

The greater part of North Mountain consists of granitoid rocks which intrude the Precambrian George River Group carbonate-clastic sequence and a 'gneissic complex', whose age and relation to the George River Group is unclear. Field mapping suggests there are possibly two major phases of granitoid rocks: a light colored, medium- to coarse-grained, massive to weakly lineated, biotite-hornblende granite to granodiorite and a pink, coarse-grained, massive, highly fractured, feldspar-megacrystic, biotite-hornblende granite(?). The George River Group consists of complexly folded quartzite, phyllite, limestone and dolomite or marble, and minor mafic volcanic rocks. All these rocks have an unusual low metamorphic grade in proximity to the surrounding granitoids and are in sharp contrast to adjacent(?) higher grade rocks of the 'gneissic complex'. The 'gneissic complex' appears to be composed predominantly of quartz-feldspar-biotite gneiss of metasedimentary(?) origin, minor orthogneiss(?), and less common intercalated carbonate rocks. These carbonate units are host to the Lime Hill zinc deposit. The 'gneissic complex' is intruded by a variety of granitoid phases from 'dioritic' to 'granitic'. The rocks of the 'gneissic complex' may represent either metamorphosed equivalents of the George River Group or a separate, older, basement unit(?).

The granitoid rocks of the area will be the subject of a detailed petrographic and geochemical study, including possible age dating, expected to determine their chemistry and petrogenesis. The host rocks will be examined to better define the environment of emplacement. In addition, the study will include comparisons of the rocks of the area with other granitoid terrains of Cape Breton Island.

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GEOCHEMICAL CHARACTERIZATION OF THE GOLDENVILLE-HALIFAX TRANSITION OF THE MEGUMA GROUP OF NOVA SCOTIA: PRELIMINARY REPORT*

M. Zentilli, M. C. Graves**, T. Mulja** and I. MacInnis****

ABSTRACT

The transition between the sandy Goldenville and shaly Halifax Formations of the Cambro-Ordovician Meguma Group of Nova Scotia has been identified as a significant locus where processes such as sedimentation, diagenesis, metamorphism, structural deformation and weathering, have led to metallic mineral concentration. Therefore, the stratigraphic interval straddling the Goldenville-Halifax transition (GHT) hosts a disproportionate number of the mineral occurrences (e.g. Au, W, As, Sb, Pb, Zn, Mn) in the non-igneous portion of the Meguma Terrane.

This project attempts to understand the physical and chemical processes that have led to this enrichment. In order to characterize the rocks of the GHT in terms of lithogeochemistry, over 400 samples were collected with excellent stratigraphic control from units above, within and below what has been referred to as the Goldenville-Halifax contact, by different workers in localities stretching from Guysborough to Yarmouth Counties.

Partial geochemical analyses of the first batch of 50 samples from the LaHave River area, show enrichment of Pb, Cu, Zn and Ba in a finely laminated, manganiferous, locally calcareous unit in the upper part of the Goldenville Formation. Similar rocks, often referred to as spessartine quartzites, or coticules, occur within the GHT throughout southern mainland Nova Scotia and are locally associated with known metallic prospects.

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*Funded by Geological Survey of Canada, Economic Geology and Mineralogy Division (Contract Number OST85-00080) under the Canada-Nova Scotia Mineral Development Agreement

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STRONTIUM ISOTOPIC STUDIES OF MINERALS IN THE SHUBENACADIE BASIN, NOVA SCOTIA*

C. E. Ravenhurst and M. Zentilli**

ABSTRACT

The source of the Ca or Ba component of calcite, barite and fluorite in Pb-Zn-Ba-F deposits can be traced using strontium isotopic ratios. Samples from a number of Carboniferous mineral deposits and rocks in the Shubenacadie Basin, Nova Scotia, have been collected and are presently being analyzed. Preliminary results indicate there is a high ^{87}Sr/^{86}Sr ratio associated with the ore-stage minerals of the larger deposits such as the Gays River Pb-Zn deposit. This suggests a mineralizing fluid source considerably different from Carboniferous marine water as recorded in the host carbonates. The use of strontium isotopes has potential applications in prospect evaluation within a known basin.

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*Funded by Geological Survey of Canada, Economic Geology and Mineralogy Division (Contract Number OST85-00052) under the Canada-Nova Scotia Mineral Development Agreement

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GEOLOGY AND MINERALIZATION OF THE WESTERN HIGHLANDS METAVOLCANIC-METASEDIMENTARY COMPLEX, CHETICAMP-PLEASANT BAY AREA, CAPE BRETON ISLAND*

H. E. Plint**, K. A. Connors**, R. A. Jamieson**

ABSTRACT

Geological mapping at the 1:10 000 scale was done in the area of the western Highlands metavolcanic-metasedimentary complex and the Pleasant Bay gneiss complex of Cape Breton Island (Map sheets 11K/10, 11K/11 and 11K/15). Known metallic mineralization in the area can now be evaluated within a better structural and stratigrapic framework. Work to date supports the concept that metamorphic grade increases gradually eastward from one complex to the other and the contact is transitional, not unconformable. A previously unrecognized pillowed basalt sequence has been mapped within the metavolcanic Highlands complex, thus posing interesting constraints on depositional and tectonic interpretations for the complex.

Polymetallic mineralization, which is the subject of past and current exploration activity, appears to be concentrated in specific metavolcanic lithologies within the western Highlands complex. Preliminary observations suggest the stratabound sulphide mineralization has undergone complex structural deformation and remobilization, and low-angle shearing had a significant role in its present distribution. The metallogenic controls and the timing of mineralization, metamorphism and deformation require further investigation.

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*Funded by Geological Survey of Canada, Economic Geology and Mineralogy Division (Contract Number OST85-00078) under the Canada Nova Scotia Mineral Development Agreement

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PRELIMINARY GEOLOGY OF THE BARRINGTON AREA, SOUTHWEST NOVA SCOTIA

S. G. Hwang* and P. F. Williams*

Mapping has been completed on the mainland between eastern Cape Sable Island and Shelburne, and some work has been done on Sandy Point southeast of Shelburne (Fig. 1). Data for the various islands have been taken from Taylor (1967) to produce a preliminary interpretation.

The area is mainly underlain by outcrops of metamorphosed Halifax and Goldenville Formations. At high metamorphic grades there is considerable difficulty in distinguishing the Goldenville and Halifax Formations. Mapping and stereonet plots indicate a large double synform that plunges less than 10° towards north.

Migmatites around Cape Sable Island show a complex deformational history which suggests progressive deformation of the type common in shear zones but outcrop is too poor to allow reliable interpretation or to allow the rocks to be related to the rest of the area. A penetrative schistosity found in much of the area has an axial planar relationship to the folds. A crenulation cleavage overprints the schistosity in the Blanche Peninsula where it is locally a penetrative feature. No related large-scale folds are known. Similarly, there is a locally penetrative crenulation cleavage on Sandy Point. The cleavage is related to known large-scale folds and has an orientation different from the crenulation cleavage on Blanche Peninsula. On Baccaro Head, Halifax Formation rocks are strongly deformed in a phyllonitic shear zone that is more than 100 m wide. Two northwest/southeast trending strike slip faults are interpreted from the disposition of the two Formations and fold axial plane traces, but neither fault is seen in outcrop.

The structure is apparently complex on Sandy Head. At the west end of the coastal section, Halifax Formation rocks dip steeply and are intersected by a westerly dipping schistosity indicating a position on the western limb of a shallowly plunging synform. Further east there are steeply dipping Goldenville rocks that young to the west and are cut again by a more shallowly easterly dipping schistosity suggesting the synform is a synformal anticline. Still further east, bedding and younging in Goldenville Formation remain the same but the cleavage dips more shallowly than bedding in an easterly direction. These observations require there be more than one schistosity or there be pre-schistosity folds. There are two other foliations found locally here: a crenulation cleavage and a differentiated layering that comprises closely spaced, discontinuous biotite-rich layers in a psammitic host rock. This area is further complicated by a conjugate pair of small, vertical penetrative faults that are symmetrical about the schistosity.

It is hoped petrological work and completion of the mapping will result in an understanding of this complex section.

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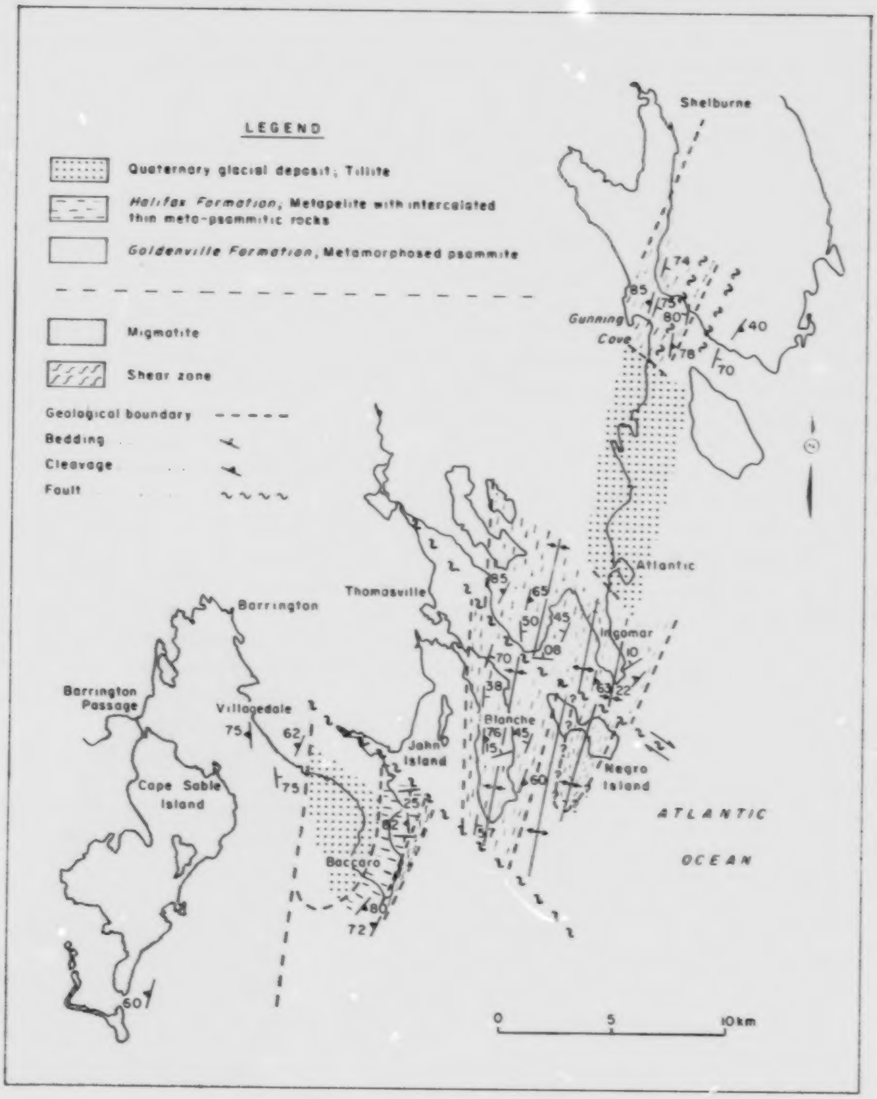

Figure 1. Geological map of the Shelburne area.

THE GEOLOGY OF THE SOUTHERN ANTIGONISH HIGHLANDS, NOVA SCOTIA*

J. Brendan Murphy**

INTRODUCTION

The southern Antigonish Highlands is predominantly underlain by Late Precambrian rocks (Georgeville Group) with Late Ordovician to Early Devonian (Arisaig Group) sequences exposed generally near the borders of the older rock. Late Precambrian rocks document the progressive opening of a sedimentary basin with a 'floor' of oceanic or attenuated continental crust. At the base of the sequence, rhyolite, basaltic andesites and basalts were subaerially deposited. However, higher up in the succession they are interlayered with, and overlain by a thick sequence of turbidites. Volcanic rocks, although co-genetic, are not co-magmatic. The basin closed in the Late Precambrian resulting in polyphase folding in the north of the map area, and supratenuous folding and faulting in the south. These rocks were posttectonically intruded by Late Precambrian appinites (H_2O-rich gabbros) and by Late Precambrian or Cambrian granites.

Late Ordovician to Early Devonian rocks consist of a broadly conformable sequence of bimodal volcanics and arkoses at the base overlain by generally shallow marine fossiliferous siliciclastics. These rocks are assigned to the Arisaig Group and probably document sedimentation in a small pull-apart basin.

The Antigonish Highlands were deformed by brittle shear zones and intruded by granitic plutons in the Middle - Upper Devonian. Shearing is especially intense in the southwestern Highlands where the Hollow and Chedabucto Faults are closely associated. These zones are characterized by intense penetrative schistocity displaying CS relationships. Localized thrusting associated with these shear zones is common. Granitoids are spatially associated with major shear zones and either use the shear zones as a means of ascent or are due to friction-induced anatexis along the fault zone.

Pyritic zones occur as:

(i) stratabound within Precambrian rhyolites
(ii) stratabound and adjacent to the contacts between subaerial and submarine volcanics
(iii) adjacent to northwest-trending brittle shear zones
(iv) adjacent to the Brown's Mountain Fault mainly in intrusive, felsic, porphyrytic dykes of Ordovician-Silurian or Carboniferous age.

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*Funded by Geological Survey of Canada under the Canada Nova Scotia Mineral Development Agreement

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A previously recorded Zn occurrence (A. Sangster, personal communication) in the western Antigonish Highlands, previously thought to be hosted by Silurian rocks, is now thought to be hosted by Precambrian turbidities and is at a similar stratigraphic level to a Zn occurrence in the Georgeville area, northern Antigonish Highlands. Thus the turbidites may have hitherto unrecognized economic potential.

CATCHMENT BASIN ANALYSIS APPLIED TO SURFICIAL GEOCHEMICAL DATA, COBEQUID HIGHLANDS, NOVA SCOTIA*

G. F. Bonham-Carter, P. J. Rogers and D. J. Ellwood**

ABSTRACT

Areal proportions of mapped lithological units are used as independent variables in a regression equation to predict the element content of stream sediments. Geochemical variation due to average differences in chemical composition between lithological units is removed from the data, highlighting anomalies due to mineralization and to secondary processes active in the surficial environment. For the Cobequid Highlands, lithological effects explain between 30 per cent and 65 per cent of the variance, depending on the element chosen. The effects of scavenging metal ions by Fe and Mn in the secondary environment are also removed by regression. Co, Ni and As show particularly strong associations with Fe and Mn.

Regression experiments also show that if geological map units are recorded as present or absent (1 to 0) in each basin, instead of using area measurements, the proportion of variance explained is almost as large. However, using only the most areally abundant unit in each basin results in about 25 per cent less efficient prediction and similar results are obtained using only the presence of the map unit closest to each sample point.

Co-occurrence of certain map units in a catchment basin appears to be a relatively important factor for predicting Zn. Co-occurrence of units is represented in the regression equation by using cross-products of lithological variables in presence/absence form.

A method for obtaining a weighted mean and a weighted dispersion for the element contents characterizing each map unit is proposed. These values are more easily interpreted than those from regression coefficients, which suffer from very large variances for map units covering only small areas.

A catchment basin map showing positive Zn anomalies after removing geological background and secondary effects due to Fe and Mn scavenging is shown as a grey-tone image, using a percentile scale. Digitization of geological and catchment basin maps allows routine production of colour or grey-tone images depicting measured or derived geochemical parameters, and provides a powerful tool for geochemical exploration.

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*Funded by Geological Survey of Canada, under the Canada - Nova Scotia Mineral Development Agreement

**Geological Survey of Canada, Ottawa, Ontario

PRELIMINARY SEISMIC STUDIES: CUMBERLAND BASIN, NOVA SCOTIA*

D. Bromley**

In July and August, 1985 preliminary seismic reflection studies were completed in Nova Scotia by the Geological Survey of Canada. This work was done in an attempt to obtain regional structure of Carboniferous strata in Cumberland Basin, and detailed structure of coal-bearing strata near Springhill, Nova Scotia.

Preliminary studies were carried out to determine the seismic transmission characteristics of the area so a full-scale survey could be planned and executed in the future. The work completed to date includes several expanding spread profiles, as well as noise, source and array testing to determine the optimum geometries necessary for production shooting.

The Springhill coalfield is situated on the southern limb of the Athol Syncline, the major structural feature of the Cumberland coal basin (Calder, 1984). A basic depositional model in terms of basin architecture has been proposed by Calder (1984).

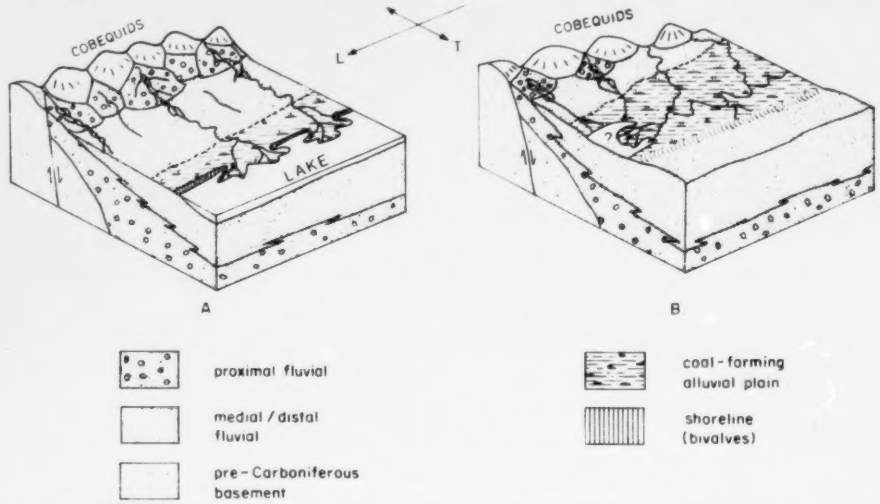

Figure 1. A basic depositional model (proposed by Calder) in terms of basin architecture.

The figure shows possible basin fill patterns taken after examples by Miall (1981), for the Westphalian B Cumberland coal basin and Springhill coalfield. To date, the western limits of coal deposition have not been defined. Depths to seams in the order of 1300 metres have been found at Springhill (Calder, 1984). For this reason an eight kilometre test line was run due west of Springhill in an attempt to delineate coal-bearing strata down to depths as great as 1500 m.

In this survey, data was collected on a 24 channel seismograph using groups of 350 Hz geophones with a three metre group interval. The

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*Funded by Geological Survey of Canada under the Canada - Nova Scotia Mineral Development Agreement

**Geological Survey of Canada, Ottawa, Ontario

source used was 0.5 lb pentomex boosters detonated with electrical blasting caps. Analog filtering was done in the 50-500 Hz range and one second of data was recorded at a one msec sample interval. The shooting geometry was chosen to be 36 m off either end of the geophone array. This arrangement provides 100 per cent subsurface coverage in both forward and reverse directions (Fig. 2).

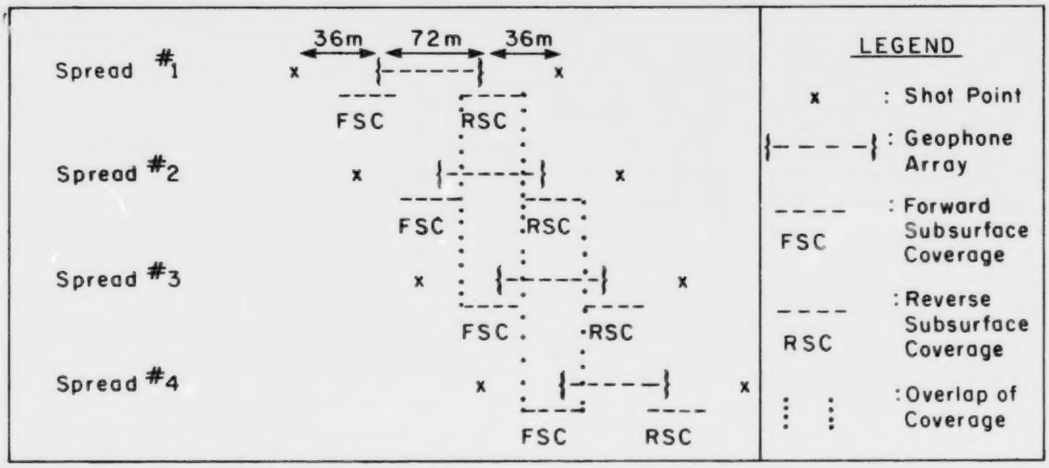

Figure 2. The shooting geometry illustrating forward and reverse subsurface coverage.

Although data processing is not complete, some initial processing was done in the field office with an Apple IIe microcomputer. This includes transfering of data from the Geometrics DMT-911 tape recorder to floppy disk via an RS232 serial interface. Once the data is stored on disk, the records may be processed individually. This includes such steps as application of normal moveout corrections, digital filtering in the 70-500 Hz pass band range, and plotting of the data with both variable area and reversed polarity to attain a more acceptable visual presentation.

Preliminary processing of the data shows several strong reflecting events. These events have general regional dips toward the west as expected in the basin. A more detailed interpretation will be possible once the data has been fully processed. This interpretation will include lithological correlation using drillhole information provided by Nova Scotia Department of Mines and Energy. Thus far the results of the preliminary studies are very encouraging.

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EVIDENCE FOR LATE CARBONIFEROUS DEXTRAL MOVEMENT ON THE COBEQUID - HOLLOW FAULT SYSTEM AND OTHER FINDINS: A PROGRESS REPORT ON THE STELLARTON BASIN PROJECT*

G. M. Yeo**

Stellarton Gap is a broad, northeast trending trough underlain by Carboniferous strata between the Cobequid and Antigonish Highlands of northern Nova Scotia (Fig. 1). The pre-Carboniferous Highland areas are bounded to the south and northwest by the Cobequid and Hollow Faults respectively. These faults subtend one another to form the Stellarton Graben containing the productive seams of the Pictou Coalfield (Bell, 1940; and others). Rapid facies changes and coarsening of clastics towards the faults, and fault adjacent localization of thick conglomerates indicate the faults were a major control on sedimentation (Yeo, 1985). Comprehension of this structural control is central to the effective analysis of the Carboniferous Basin. Other work undertaken in the 1985 field season included stratigraphic investigation of the Stellarton and 'Merigomish' Formations. Some of the preliminary results may be given.

The Cobequid Fault system dies out north of Thorburn. It does not cross Sutherlands River. The Hollow Fault dies out south of Westville. Field observations of meso-scale structures and structural analysis of fracture patterns along the eastern Cobequid and Hollow Faults reveal Late

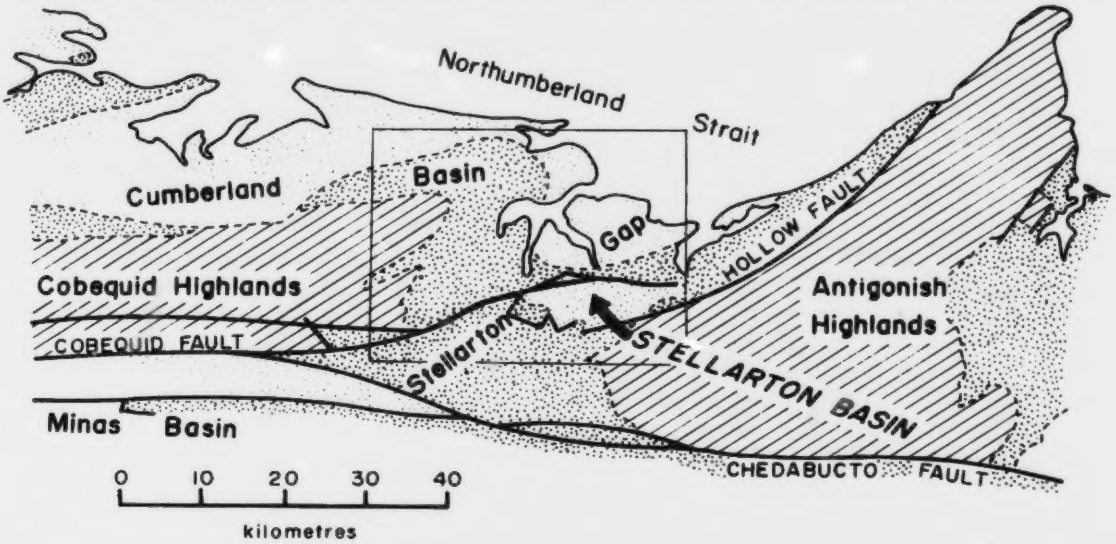

Figure 1. Location map of northern Nova Scotia. Pre-Carboniferous rocks are indicated by the ruled pattern. Early and middle Carboniferous strata are shown in heavy stipple. Late Carboniferous strata (Pictou and Stellarton Groups) are shown in light stipple. The New Glasgow map area (Yeo and Murphy, in press) is outlined.

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*Funded by Geological Survey of Canada under the Canada - Nova Scotia Mineral Development Agreement

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Carboniferous movement on both faults was dextral (Yeo and Gao, in press). The offset of Devonian volcanics along the Cobequid Fault (Donohoe and Wallace, 1985) and Silurian strata along the Hollow Fault, indicate displacement of 20 to 35 km. Deformation and orientation of secondary faults and folds within the Stellarton Graben indicate a large-scale, dextral, Riedel shear pattern. These findings are consistent with a study by Eisbacher on the western Cobequid Fault (1969) and confirm the work of others who speculate dextral movement on the Hollow Fault. In response, the Stellarton Graben developed as a synsedimentary rhomb graben in late Westphalian B-C time. Consequently, it is unlikely the coal seams within the graben extend outside but the Thorburn coals are a possible exception. Juxtaposition of unlike facies belonging to the partly time-correlative 'Merigomish Formation' (described below) and Stellarton Formation is also explained by the dextral faulting. The Stellarton Graben could not have been an obstacle to derivation of the New Glasgow conglomerate from a southern source area since the graben probably did not exist in early Westphalian B time.

The name, 'Merigomish Formation', is informally proposed for the Pictou Group in Stellarton Gap. It consists of a thick sequence of grey beds (approximately 1800 m), well-exposed in the Merigomish area. The formation lies disconformably(?) upon the New Glasgow conglomerate, and is overlain by redbeds of the Tatamagouche Syncline (Ryan, 1984). Three members can be distinguished in the 'Merigomish Formation'. The lowest and thinnest of these is the Smalls Brook Member. This comprises grey sandstones, with local thin basal conglomerate, and minor grey and red siltstones, overlain by a lacustrine limestone unit (Moose Fraser's Limestone) and capped by a shaly coal seam (the Munro Seam). In the Merigomish area, Fraser's Limestone includes oncolites, and domal and columnar stromatolites, resembling those from the Morien Group described by Mason and Rust (1983). To the west, this marker unit passes into a locally bioturbated, calcareous sandstone. Oil shales on Smalls Brook south of Anderson Mountain may be local lacustrine correlatives of the Munro Coal. The Smalls Brook Member is overlain by the Big Island Member, a sequence of grey, massive and crossbedded sandstones with minor grey and red siltstone, interpreted to have been deposited by northerly flowing braided rivers. This in turn is overlain by the Caribou Member, a sequence of thick, lenticular, grey, crossbedded sandstones, and red and grey floodplain siltstones with coal seams up to 40 cm thick. The Caribou Member is interpreted to be the deposits of northerly flowing, anastomosing rivers. The 'Merigomish Formation' may be correlated with the Pictou grey bed unit (Ryan, 1984) in the Tatamogouche Syncline. Correlations of the lower part of the 'Merigomish Formation' with the uppermost Thorburn Member of the Stellarton Formation (Haites, 1956; and others) is also proposed.

The tectonic framework for the development of Stellarton Graben provides a context for detailed studies of the clastic stratigraphy of the Stellarton and 'Merigomish' Formations being done by L. Daigle and R. Snow at Acadia University and M. D'Orsay at University of New Brunswick. Gao Ruixing at University of New Brunswick is undertaking a microstructure study to relate microfabrics to structures observed in the fault zones and to better understand the nature of brittle deformation.

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GRANITE PLUTONS IN THE EASTERN MEGUMA TERRAIN*

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INTRODUCTION

Recent discoveries of mineralization associated with the South Mountain Batholith have instigated a two to four year mapping project involving granitoid plutons east of Halifax. The initial phase of this project, during the summer of 1985 involved mapping at the 1:25 000 scale of the Chedabucto peninsula east of longitude 61°13'.

In general, the area is underlain by Cambro-Ordovician metasedimentary rocks of the Meguma Group and numerous Devonian(?) granitoid plutons. Outcrop is superb along the coast but diminishes significantly in quality and abundance toward the interior with corresponding reliability variation of the geological data (Fig. 1).

The area was previously mapped by Faribault (1893), Weeks (1959) and Stevenson (1964). Since 1950, extensive exploration of various scheelite, chalcopyrite and andalusite occurrences in the Meguma Group has been done by several companies. University theses covering various aspects of the geology have been completed (Schiller, 1959; Nichols, 1976; Shaw, 1983; Poole, 1984). One granite pluton near Whitehead was dated at 368 ± 8 Ma (Reynolds et al., 1981). Keppie (1985) described the structural history of rocks in the southeast corner of Durells Island.

GENERAL GEOLOGY

The map area lies in the eastern part of the Meguma terrain immediately south of the Minas Geofracture (Keppie, 1982). The oldest rocks belong to the Cambro-Ordovician Meguma Group. The Goldenville Formation is divided into two subunits: laminated metawacke thinly interbedded with minor metapelite (Unit 1a) and relatively massive metawacke beds up to ten metres thick (Unit 1b). As the contact with the younger Halifax Formation is approached, the Goldenville Formation beds decrease in thickness and the proportion of metapelite increases. The contact between the Goldenville and Halifax Formations (Fig. 1) was drawn using a 1:1 ratio of psammite to pelite.

The Halifax Formation is divided into three subunits: muscovite-biotite-chlorite schist and phyllite, containing local porphyroblasts of cordierite and garnet (Unit 2a), andalusite schist (Unit 2b), and graphitic schist commonly containing porphyroblasts of andalusite (Unit 2c). At *three places along the north shore of Whitehead Harbour, a five metre thick* sill of rhyolite containing phenocrysts of feldspar and quartz is observed to intrude the Halifax Formation.

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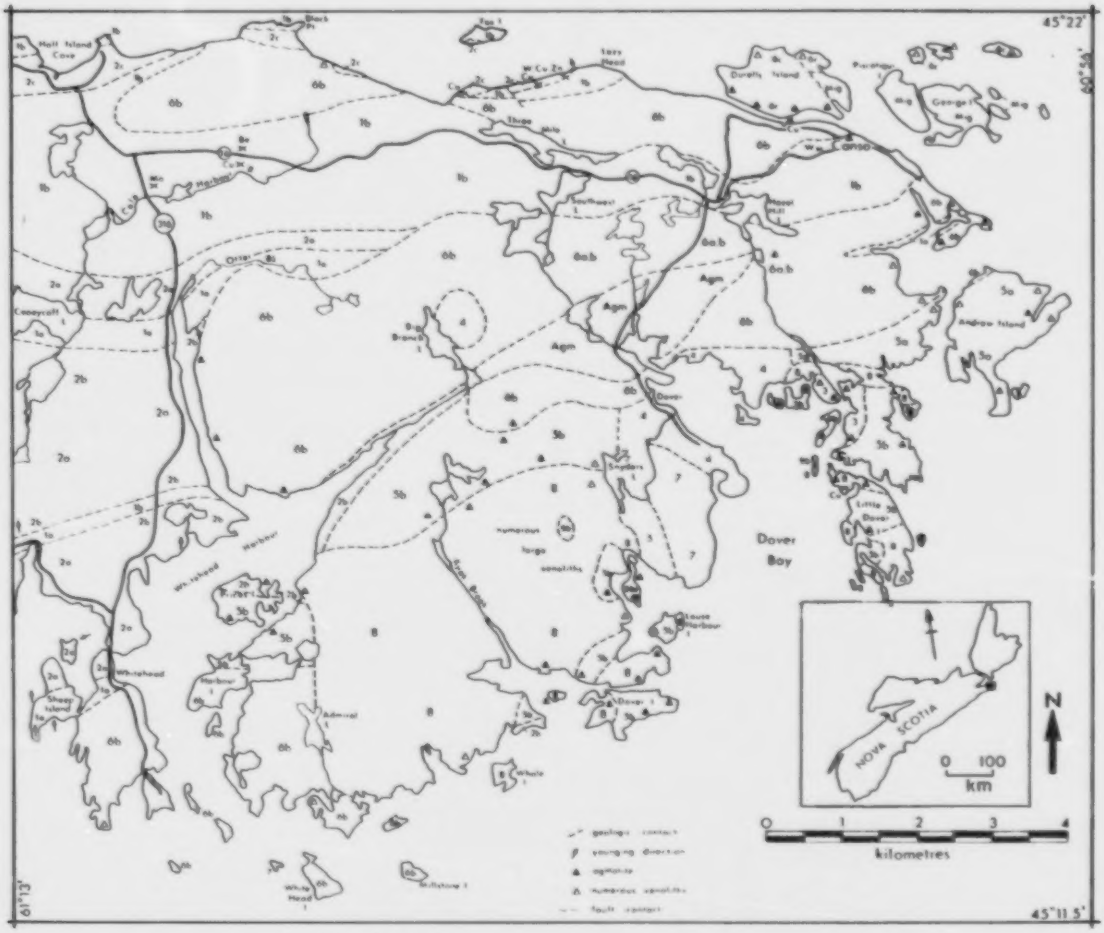

Devonian(?) Granitoid Plutons

8 - medium- to coarse-grained seriate biotite granodiorite to granite
7 - medium grained muncovite granite
6 - polyphase medium grained granite; a - biotite>muscovite; b - muscovite>biotite; c - medium- to coarse-grained muscovite>biotite.
5 - coarse grained seriate biotite granodiorite to granite
4 - fine grained biotite-muscovite granite
3 - medium grained biotite tonalite

Cambro-Ordovician (Meguma Group)

2 - Halifax Formation; a - micaceous phyllite and schist, locally porphyroblastic; b - andalusite schist; c - graphite schist, locally porphyroblastic.
1 - Goldenville Formation; a - laminated metawacke and minor phyllite; b - massive metawacke.

Agm - agmatites of Meguma Group, granite and granite pegmatite

Mig - Banded migmatite containing layers of metawacke (Unit 1), contaminated tonalite gneiss and granite (Unit 6c)

Figure 1. General geology of the Canso area.

More than 20 plutons ranging in composition from biotite tonalite to muscovite granite, intruded the Meguma Group rocks during the Devonian(?). Based on age relationships, texture and lithology, the plutons have been grouped into six units. In addition, numerous igneous bodies, including several rock types not represented in Units 3 to 8 are present but are too small to show in Figure 1. Observed interplutonic contacts are intrusive with typical zones of agmatite ranging from a few metres to few kilometres in width. Individual contacts tend to be planar, suggesting a control by pre-existing fractures. The complete sequence of intrusive events was not determined. Units 3, 5, 6b and 8 are given in the correct stratigraphic order but the relative ages of Units 4, 6a, 6c and 7 are much less certain. The lack of a simple correlation between age and composition suggests the plutons were generated by more than one phase of partial melting.

During the Acadian Orogeny, the Meguma Group was deformed and metamorphosed to amphibolite grade. Contact metamorphism related to the granitoid intrusions overprints Acadian porphyroblasts. Both the Meguma Group rocks and the granitoid intrusions were deformed and metamorphosed to greenschist grade during a prolonged event of dextral shearing which Keppie (1985) has correlated with transcurrent movements along the Minas Geofracture.

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PRELIMINARY REPORT OF THE GEOLOGY OF THE MAHONE BAY AREA, NOVA SCOTIA*

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ABSTRACT

The Mahone Bay area in Lunenburg County, Nova Scotia is underlain by Cambro-Ordovician metasediments and Devono-Carboniferous granitoids. These in turn are unconformably overlain by Lower Carboniferous limestones, evaporites and clastic rocks. The Cambro-Ordovician Meguma Group is subdivided into three formations and six members which together are approximately 13 km thick. However, lateral facies variations and stratigraphic thickening and thinning of map units are common.

Rocks of the Meguma Group are folded about variably plunging, northeast-southwest trending major folds. Individual folds are mapped for many tens of kms, and change their shape in different units along the axial trace. Fractures are present in Meguma Group metasediments, Windsor Group limestones and Devono-Carboniferous granitoids. Some fractures are occupied by quartz veins or acidic to basic intrusions.

Regional metamorphism of the Meguma Group is in the lower greenschist facies but contact metamorphism near the granitoids has produced an amphibolite facies hornfels.

Quartz veins at various structural and stratigraphic positions in the Cambro-Ordovician rocks contain Au, W and Cu. Laminations in certain members of the Meguma Group are especially rich in Mn.

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*Funded by Geological Survey of Canada under the Canada - Nova Scotia Mineral Development Agreement

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GEOLOGY OF THE NUMBER 9 TRENCH, LIME HILL PROSPECT, NOVA SCOTIA[1]

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SUMMARY OF POSTER DISPLAY

The Lime Hill zinc occurrence is located near West Bay, Inverness County, Nova Scotia. It was discovered in 1957 by Dr. B. Keating. Since then, the occurrence has been explored by several campaigns of geological mapping, geochemical sampling, geophysical surveys and trenching. Various targets within a two square kilometre area have been tested by 82 diamond-drill holes totalling in excess of 4 600 m (Patterson, 1985).

The Lime Hill occurrence lies within marble of the Precambrian George River Group. Sphalerite with minor pyrrhotite and pyrite occur in serpentine and non-serpentine-bearing marble which is intruded by granite. Minor galena, tetrahedrite, bornite and scheelite have been reported (Chatterjee, 1977).

Three types of sphalerite mineralization are visible in Number 9 trench. The first, and earliest, consists of two to four cm thick layers of abundant disseminated sphalerite that parallels the lithological contacts in serpentine-calc-silicate marble. The sphalerite layers are deformed about subhorizontal axes and appear, in places, to be truncated at low angles by a 0.25 - 2 m zone of massive to submassive sphalerite. The former, massive sphalerite, is the dominant mineralization in the trench. It is exposed over a length of 55 m and is folded about moderate to steeply plunging axes. The sulphides show significant thickening in one of two fold hinges. The third kind of sphalerite mineralization occurs as layers of disseminated sphalerite in the marble foliation, paralleling the contacts of the massive sphalerite zone.

This study indicates the Lime Hill mineralization has a strong element of structural control which is similar to the Grenville-type zinc occurrences (e.g. Balmot Edwards). Exploration for this type of deposit requires detailed drilling of complex structures to define high grade lenticular to 'pencil-shaped' ore bodies within fold hinges. Previous drilling done at Lime Hill was based on a model of tabular mineralized zones. This can result in apparently erratic intersections of highly variable grade and thickness which are difficult to correlate.

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COMPUTERIZATION OF COAL EXPLORATION DATA FOR NOVA SCOTIA*

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Under the Canada-Nova Scotia Mineral Development Agreement, the Geological Survey of Canada Institute of Sedimentary and Petroleum Geology (ISPG) has implemented a program, proposed by the Nova Scotia Department of Mines and Energy Coal Section, designed to develop a comprehensive computer database of coal exploration and analytical data from the Nova Scotia coalfields. Over 100 years of data from the coalfields exists primarily in hard-copy form in the files of Nova Scotia Department of Mines and Energy, and the Cape Breton Development Corporation. The problems of storage, handling and accessibility of such volumes of material are self-evident, just as are the advantages of storing it in a sophisticated computer database.

Over the past several years, the Coal Resource Evaluation Section of ISPG has been developing a coal geological database for the National Coal Inventory. This consists of information from drillholes, outcrops, adits and trenches as well as coal quality data from analyzed samples. Information from mining operations can also be incorporated (e.g. coal seam channel samples). Concurrently, computer-based methods for display and manipulation of this information have been developed (Hughes, 1984). Manipulation of the databases will aid in assessment of the geology, depositional setting and resource quantities of Nova Scotia coal deposits.

The project was initiated in February 1985 with installation at the Nova Scotia Department of Mines and Energy of a CRT terminal connected by a 1200 baud dedicated line to the ISPG HP-3000 computer in Calgary. Using these facilities, a contracted geologist and a data entry technician have access to all the necessary software for data collection and display. Lithological information is interpreted, according to a consistently defined set of criteria, by the geologist using the best available data from geophysical logs, core descriptions, outcrop descriptions, etc. All input data are subsequently displayed in hard-copy form for vertification.

The 1985-86 program calls for the preparation of computer files of coal exploration data for the Sydney Coalfields and other smaller coalfields of Cape Breton Island. This entails coding of some 800 drillholes with an aggregate length of over 83 000 metres, approximately 100 outcrop descriptions each with about 15 lithologic units, and about 3 000 channel samples and descriptions, each with an average of 6 lithologic units with accompanying ply analyses. Other analytical data are available for over 1 200 samples. As well, detailed topographic, bathymetric and sea-floor sediment maps of the Sydney Coalfield are being digitized.

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*Funded by Geological Survey of Canada under the Canada - Nova Scotia Mineral Development Agreement

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In subsequent years, similar computer files will be generated for the Cumberland and Pictou Coalfields.

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